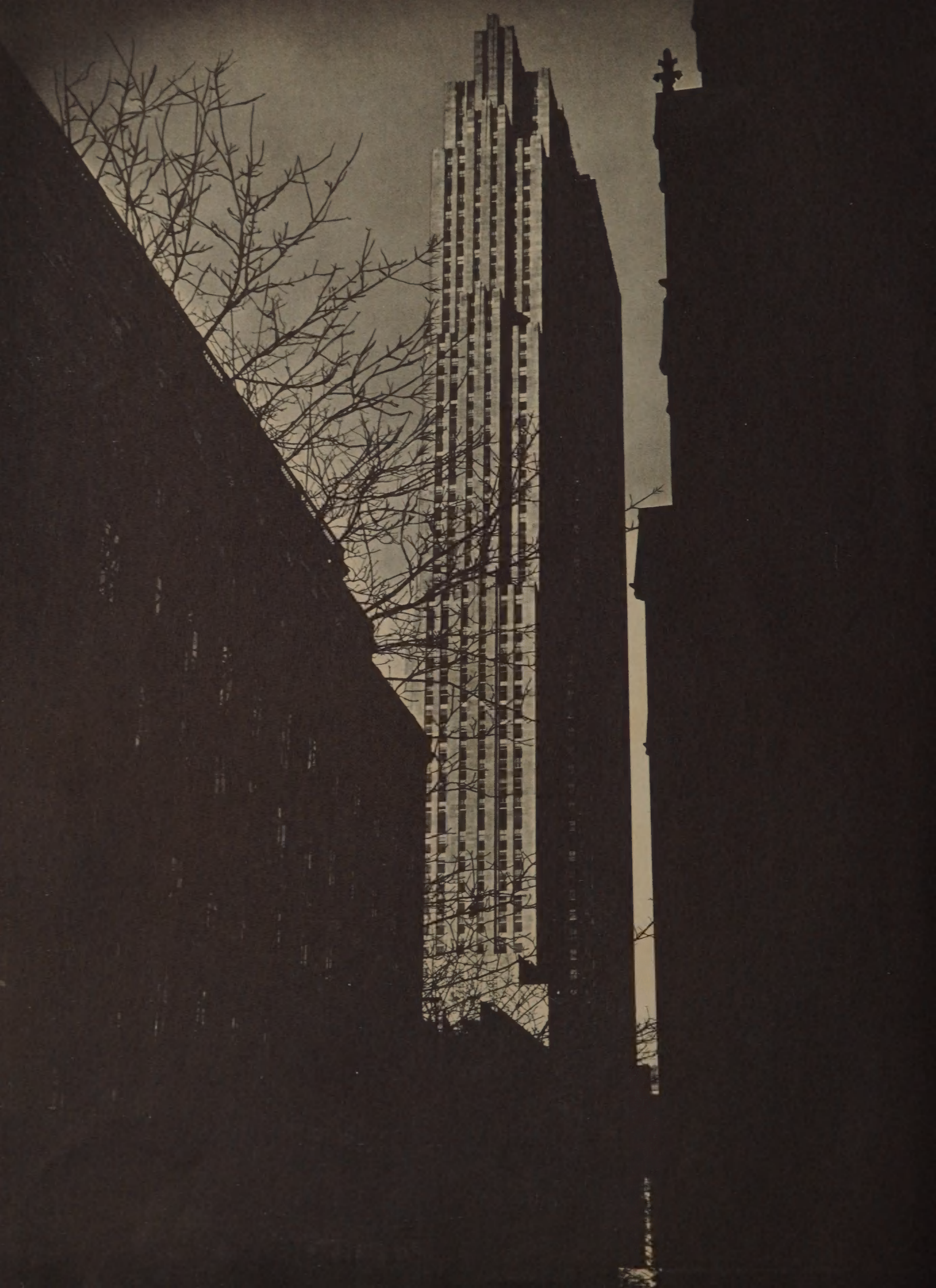
The Lamp

September 1951



The **Lamp**

September 1951

VOL. 33, NO. 3

CONTENTS

FLETCHER MARTIN'S watercolor on the front cover shows a cantilevered ramp leading to the West Side Highway from a street in downtown New York. The painting is one of a portfolio reproduced in this issue to record the architecture of the modern road.

Mr. Martin, a self-taught artist, had his first one-man exhibition in 1934 at the San Diego, California, Fine Arts Gallery. Since then he has been artist-in-residence at the State University of Iowa and head of the department of painting at the Kansas City Art Institute. This fall he will serve as director of the University of Florida's art department. His work is represented in a number of public and private collections.

CREDITS: *Cover*, Fletcher Martin; *Pages* 3, 5, Rolf Klep; *Pages* 6-7, Richard Erdoes; *Pages* 11-15, Fletcher Martin; *Page* 16, Wittich Holloway; *Page* 21, Rolf Klep; *Back Cover*, John Gaydos.

STANDARD OIL COMPANY (*NEW JERSEY*)

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Published four times a year (March, June, September, November)

primarily for employees and stockholders

Each company affiliated with Standard Oil Company (New Jersey) manages and controls its affairs through its own directors and officers. The use of such terms as "company," "Jersey," "organization," "our," and "its," when applicable to such companies is only for convenience and simplicity.

THE RCA BUILDING in New York's Rockefeller Center is the home of most Jersey company employees. Its seventy stories make it the tallest building in the Center

UP FROM THE ASHES

A major refining industry is rising from wartime ruins to meet Europe's oil needs

LOOKING back from the Europe of today, it seems incredible that only six years ago millions of Europeans were slowly starving in the cellars of their ruined cities. It is just as difficult to believe that millions shivered through the first winter after the war, huddled miserably behind cardboard windows in unheated rooms.

Their traditional source of warmth had been coal—but when the war ended there was little coal to be had. The mining industry was too badly wrecked, its transport too badly battered to provide coal on anything like the old scale.

To warm its people, to revive its industries, western Europe turned to oil. But oil, too, was lacking.

Most of the refineries were twisted, burned and gutted ruins when the bombing ended in 1945.

Bulk plants and terminals had been destroyed, their storage tanks collapsed and fire blackened.

Tankers had been sunk at sea. Tank barges had gone down at their loading docks. Railroad tank cars had been blasted to bits or had vanished into thin air, to be found months and even years later, wandering over half the railroads of Europe.

But worst of all, perhaps, for the resumption and expansion of the flow of oil to western Europe, was the dollar shortage.

Producing but a trickle of oil itself, western Europe had always imported the bulk of its supplies from the giant refineries of the United States and the Caribbean area. A much smaller portion of Europe's oil had come across the Atlantic as crude, to be turned into usable products by the few small refineries in England and on the Continent.

After the war, this minor portion of the oil supply suddenly assumed a new importance.

Crude oil was cheaper than refined products. Europeans could spend $3 to import refined products or they could obtain the same quantity of products by spending $2 for imported crude oil and then paying their own refinery workers in their own currencies to turn the crude into needed fuels and lubricants.

With western Europe not only short of dollars but unlikely to earn more very soon, the course to be followed was clear. But how best to proceed?

TO the men who had to find a way, who had to start oil moving again to western Europe at a minimum cost in dollars, the task represented far more than an industrial problem in supply and demand.

They were Europeans. They had been on the scene when the plants they had helped to build were destroyed. The devastated countries of 1945 were their own countries. And the people who had shivered and starved through the winter of 1945–46 were their friends and neighbors.

With the incentive of a deep personal interest and with the aid of affiliated suppliers like Standard Oil Company (New Jersey) overseas, Europe's oilmen went to work.

Their first job was to survey their war-torn facilities to find out exactly how much equipment could be used. There was not very much, for losses had been staggering.

Men from Jersey affiliates, for example, found that seven out of ten of their refineries had been wrecked; that four-fifths of their refining capacity was gone. They discovered, too, that old staffs of skilled, long-service employees had disappeared—some into the armies and resistance groups, others into prison camps, and no man knew where they were or how many were still alive.

Reading across the Continent from west to east, the roll call of Jersey's wrecked refineries was a grim one—Port Jerome and La Mailleraye in France; Ebano in Germany; Vallo in Norway; San Sabba in Trieste; Fornovo in Italy; Teleajen in Rumania. On V-E day, Jersey had but three refineries in Europe which were still intact—Fawley on Southampton Water in England; Atlas, a small topping plant, at Antwerp in Belgium; and a little asphalt plant at Kalundborg in Denmark—and all three were shut down for lack of crude oil.

The second job of Jersey men, and a relatively simple one, was to restart the flow of crude oil to the three intact plants. Though these refineries could produce only a small part of the oil products that were so badly needed, their output would at least help to start the wheels of recovery turning. By October 1945, it became possible to import South American crude and the three intact refineries went back on stream.

The third job, and in every way a far more difficult one, was to rebuild the wrecked refineries at the earliest possible moment. If ever there was a case of making bricks without straw, this was it.

Anyone who had to piece together a working refinery from the shambles war had left would have much preferred to shove the wreckage out of the way and build anew. But new materials and equipment were not to be had. Initially, at any rate, the ruined plants had to be rebuilt with material in most instances salvaged from their own remains.

As part of one salvage operation, Jersey oilmen in Europe searched the Continent for parts of a refinery that were missing entirely.

During the war, Port Jerome refinery had been burned to keep it from serving the enemy. When the invaders came, they dismantled entire units and shipped them away. Eventually, Port Jerome men found the stolen equipment hundreds of miles away in refineries of Central Europe. They tore it down, piled it on a long freight train and sent it back to Port Jerome.

By such dogged efforts, supplies of usable materials gradually were accumulated.

BUT far more was missing than materials and equipment. Skilled hands were few. Food was scarce. So was housing. Tools, exhumed from the wreckage of machine shops, were found to be damaged or useless. Nails, rivets, pipes of all sizes, valves, fire brick, packing, electrical equipment were virtually impossible to obtain. Working conditions through the winter of 1945–46 were miserable; and even after the makeshift units had been reassembled and re-erected, leaky valves and poor rivets made their operation a constant nightmare.

Nevertheless, the wrecked refineries began rising, one by one, from their ashes. As rapidly as possible, new equipment replaced old. And the flow of refined oil products grew steadily larger.

Before the war, Jersey's ten refineries in Europe had turned out finished products at the rate of 60,000 barrels a day. On V-E day they could not refine a single barrel of crude oil. Yet from zero in 1945 their out-

REFINERIES of Jersey's affiliates in Europe are being expanded to over four times their prewar capacity. Six years ago seven out of ten of them were gutted wrecks

put rose to 55 per cent of their prewar level in 1946; to 73 per cent in 1947; and to 103 per cent in 1948.

The record of recovery was marred only by the setback suffered in 1948 when the Rumanian government expropriated the newly rebuilt Teleajen refinery. This was one of a number of incidents which have restricted the operations of Jersey's European affiliates to the countries that lie west of the iron curtain and to the Allied sectors of Berlin and Vienna. But these are the countries of free Europe. They have the largest concentrations of industry and industrial skills in Europe, the highest living standards and the greatest need of oil.

By 1950, all the wrecked refineries of the Jersey group in western Europe had been restored to production, and additional refineries had been acquired at Leghorn and Bari in Italy. Jersey's refinery production in Europe had risen to 166 per cent of its prewar level, or 100,000 barrels of finished products a day; more than three-fourths of this output of products was refined from crude oil imported from the relatively new fields of the Middle East for which western Europe is a natural outlet.

But the rebuilding of the refineries was no more than a beginning.

Even as they stood amid the ruins of 1945, oilmen had realized that western Europe's traditional oil industry, based on imports of refined products from the Americas, had come to an end and could not be restored on anything but a stop-gap basis.

They knew the dollar shortage would compel western Europe to buy its oil in the cheaper form of crude and do all its own refining, a job which Europe had never attempted and for which it was ill equipped. In brief, Europe's oilmen knew they would have to build a new refining industry of major proportions and would have to build it quickly.

This, the biggest job of all, was being planned as far back as V-E day.

It would mean painstaking negotiations with national and local governments. It would take huge quantities of steel. Thousands of blueprints and specification sheets for the new refineries would have to be drawn up. Hundreds of thousands of equipment items would have to be ordered, manufactured and delivered. Above all, the creation of a new industry for western Europe would take time. And time, measured in terms of the expanding demands for oil, was pressing.

Because the coal shortage threatened to become permanent, more and more consumers wanted to switch to oil. At times their numbers seemed limited only by the availability of oil burning equipment.

In the prewar years, Europe's use of residual fuel oil had been confined almost exclusively to ocean-going ships. But after the war, this heavy black fuel began to replace coal in rebuilt office buildings, hotels and apartments. In reconstructed factories and mills and power plants, it helped the recovering countries to overtake and pass their prewar production rates. By 1950, western Europe's industrial output was running 30 per cent above that of 1938.

Transportation, too, was using more and more oil in the postwar years. In a continent so deeply penetrated by the sea and so networked with navigable rivers and canals, slow-moving coastal ships and barges carry most of Europe's bulk freight. In time, these vessels became so generally converted to residual fuel oil and Diesel

FARM TRACTORS have increased more than three times over since 1938 and have been a major factor in raising Europe's oil demand to its present record level

fuel that today some of Britain's coastal colliers burn fuel oil under their boilers, even though their cargo holds are full of good steam coal.

The swelling postwar use of oil also became increasingly apparent on Europe's roads and highways.

In Italy, 300,000 buzzing motor scooters suddenly created a demand for a special fuel. It consisted of gasoline and lubricating oil and was supplied at service stations, ready mixed.

German and Italian countrysides for years had echoed the rush and roar of big, long-distance trucks and busses. Elsewhere on the Continent, and in the British Isles, most of the prewar truck traffic had consisted of light pick-up and delivery vans. The war was not very long past before these small highway users were moving over to make room for massive, 10-ton carriers. And with the lowering of frontier barriers, international trucks and busses began to travel in almost all directions.

STILL another major contributor to Europe's rising demand for oil has been the farm tractor. In countries outside of Russia, these versatile vehicles have more than trebled in number since the years before the war. By the hundreds of thousands they have made life easier for the farmer. With the Dieselized fishing fleets, they have made possible larger and surer supplies of food.

On land, on sea, even in the air, western Europe's expanding use of oil had, by 1950, pushed consumption to just under 1,300,000 barrels a day. (Before the war, the whole of Europe excepting Russia had consumed only 800,000 barrels daily.) But by 1950, the new refinery construction by Jersey's affiliates was moving ahead at top speed and was pretty well keeping abreast of the soaring demands for finished products.

Construction had been pushed nearest to completion in Britain, not only because Britain was the largest market in Europe, but even more perhaps because Britain stood at the head of the sterling bloc of countries which were so short of dollars.

Original plans of Esso Petroleum Company, Limited, Jersey's British affiliate, had called for the expansion of Fawley refinery from its prewar capacity of 18,000 barrels a day to 110,000 barrels, which would make it the largest refinery in Europe. Final agreement with the British government was reached in April 1949, and no major refinery has ever gone up with greater speed. Last July, after only two years of actual construction, the first Middle Eastern crude oil was fed to the first pipe still; and by the end of this year, the new Fawley is expected to be producing its 110,000 barrels of refined products a day.

Since the original plans were drawn up, it has been decided to add further equipment which eventually will increase Fawley's daily capacity to some 130,000 barrels. The refinery will then produce all but about 2 per cent of the needs of Esso Petroleum Company for the British and Irish markets.

Across the English Channel and a little way up the Seine from the big French port of Le Havre, the Port Jerome refinery is undergoing an expansion which will more than double its prewar capacity. Farther up the Seine, the little La Mailleraye refinery has been restored to its prewar output of 600 barrels a day of highly refined specialty oils. When the expansion of Port Jerome has been completed, these two refineries will enable Standard Française des Pétroles, Jersey's French affiliate, to produce from Middle Eastern crude virtually all the supplies it needs for its French and North African markets.

In Italy, the Leghorn and Bari refineries are being modernized and will eventually have a combined capacity more than twice that of the prewar years.

In the outer fringes of the German port of Hamburg, Ebano, a small asphalt plant before the war, is being converted to a general refinery and its capacity will be expanded to three times its prewar level.

Under construction at present, the new Antwerp refinery in Belgium is to open with an initial production that will enable Jersey marketing affiliates in Belgium, Holland and Luxemburg to bring their imports of refined products virtually to an end.

By the end of 1953, the Jersey group's European refining capacity will reach 280,000 barrels daily, or 466 per cent of its prewar level.

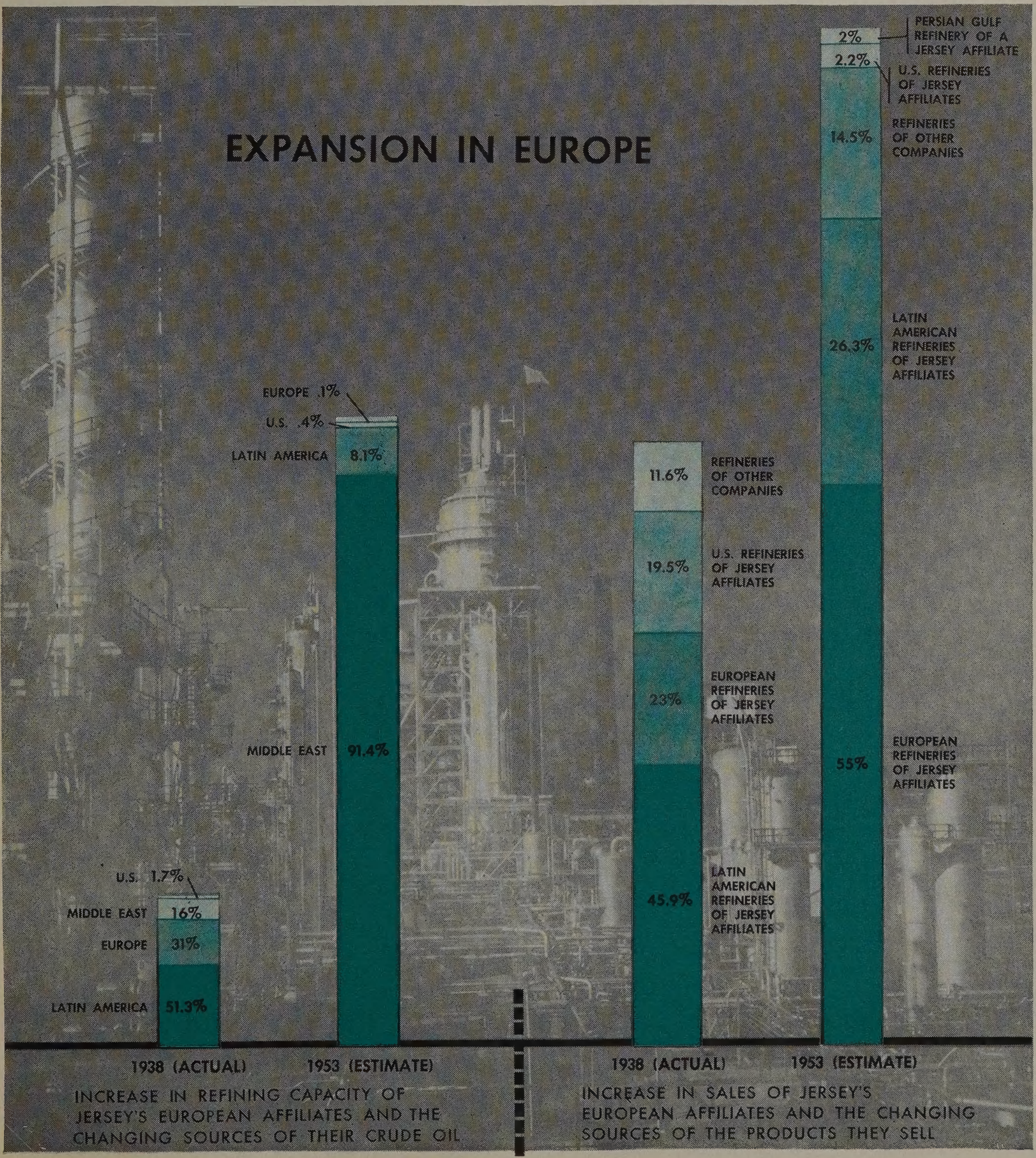
In seven of the free countries—Britain, France, Italy, Germany and the three Benelux countries—the affiliates will then be refining very nearly the whole of their market requirements, mainly from Middle Eastern crude.

In five other countries—Denmark, Norway, Sweden, Finland and Switzerland—Jersey affiliates will continue for the present to import at least a portion of their supplies in the form of finished products from abroad.

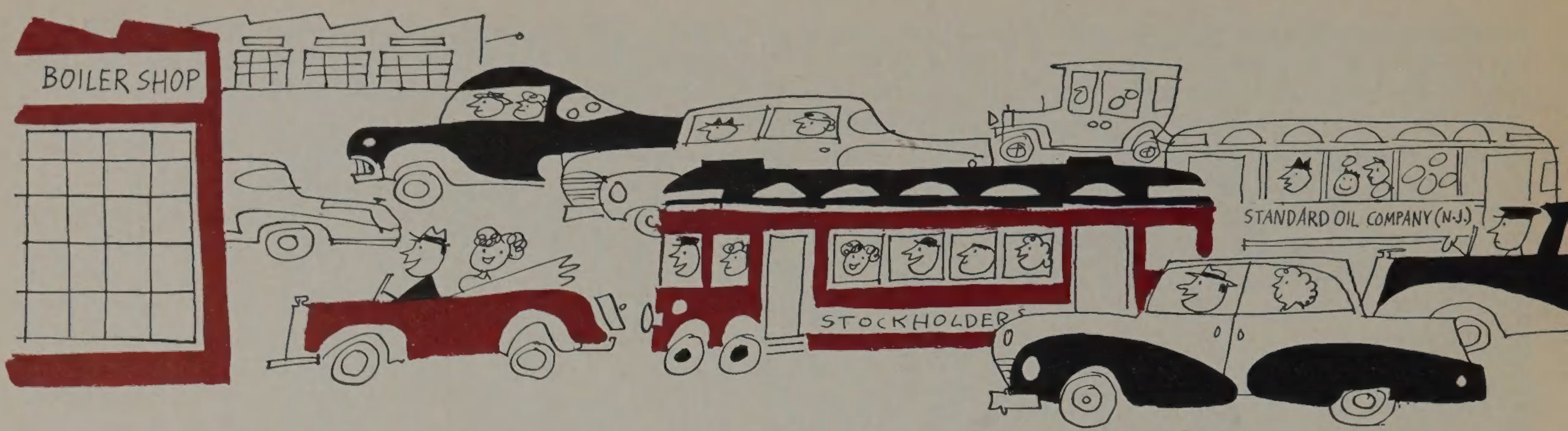
But while the Western Hemisphere's refineries supplied two-thirds of all the oil products sold by the Jersey group in Europe before the war, in 1953 they will provide only about a fourth. Little by little, Europe's new oil industry is shaking itself loose from the traditional product imports of its past.

Both the Western Hemisphere and the Middle East are ready for the major shift in the world's traditional oil flow which free Europe is bringing about. With needs for petroleum products in the Americas expanding, the Western Hemisphere's refineries will soon have no exportable surplus left for Europe. The Middle East, on the other hand, has ample crude oil to supply free Europe's new refineries. Relatively small development programs can increase its production if necessary; and its proved reserves underground, although still incompletely explored, are among the largest in the world.

The Jersey group has been but one of the major suppliers of oil to Europe who have seen the new era coming and have worked to lay its foundations in the Western Hemisphere and the Middle East as well as in Europe. Even amid the devastation of 1945, they had faith in Europe and in the ability of its tenacious peoples to rebuild what had been destroyed. They were confident of its recovery. They believed then, as they do now, that cheaper and more abundant oil has a role of the utmost importance to play in making and keeping the free countries strong.



BUILDING REFINERIES enables Europe to increase its imports of crude oil and taper off its imports of the costlier refined products, thus saving needed dollars



THE MEETING IN THE

Editor's Note: This description of Jersey's 1951 annual meeting is written from the personal viewpoint of a Lamp *staff writer who is a stockholder. It is an informal account which it is believed will be of interest to* Lamp *readers generally.*

HOLDING it in a boiler shop gives a meeting an unusual touch, no matter what else. This was the first Jersey stockholder meeting I ever attended, and it left me slightly open-mouthed.

Like every stockholder, I had received notice of the time and place of the meeting. It was after I returned the card indicating I planned to attend that I sensed that invisible machinery had begun to roll.

I received a cordial letter from Frank W. Abrams, the chairman of the board. I received directions for reaching the meeting place, Esso Standard Oil's Bayway refinery at Linden, near Elizabeth, New Jersey. I received a road map of the vicinity, a program of the meeting, an admission card.

I was informed that there would be local bus service, a free lunch and a guided tour of the laboratories. I was offered, for the asking, a road map with a marked route to the refinery from any place in the United States or Canada.

And, although the company didn't tell me so in advance, it was also prepared, though perhaps less anxious, to feed my chauffeur, walk my dog, care for my children in a nursery, remove foreign bodies from my eye and roll up my car windows in case of rain.

Along with other stockholders, I went by train to Elizabeth. Company people met us on the station platform and asked if we had brought our admission cards.

I had mine, but a few stockholders had forgotten.

No crisis resulted, however. Someone was sitting at a phone with an open line to an office having an alphabetical list of all 222,000 stockholders. As soon as a name was located, a new card was issued.

In one of the busses the company had chartered for the day we rode to the refinery. Stockholders who came by auto left their cars in a parking lot some distance from the plant and took busses the rest of the way. The company figured somebody might lock his car doors without shutting off the motor, so there was a locksmith ready to open doors after the car's owner had been paged at the meeting.

When I had surrendered my admission card and received a souvenir pencil with a miniature can of Esso Motor Oil floating in a transparent cylinder of oil, I walked into the boiler shop.

Now a boiler shop is a place where steel plate is banged into shape. I had wondered if they were going to hold the meeting in pantomime. The Bayway boiler shop, though, surprised me.

It is 540 feet long and 110 feet wide, all white except the floor, which is light green. It was so quiet I could hear birds chirping on the crossbeams high overhead. (The night before, riggers had hung shallow boxes beneath the nests of the swallows which make there summer homes up there.)

There was no work going on in the shop. The presses, punches, benders and drills, smartly cleaned and painted, bore placards describing their functions.

These machines were off toward the sides of the shop. In its uncluttered center, arrayed like a regiment standing inspection, were more than 2,000 chairs. In front of them was a speaker's platform.

But these filled only about half the shop. The other half was hidden by a backdrop behind the platform. Fourteen loudspeakers hung from the roof. Along the walls were checkrooms, information booths, models and pictures of pipelines, tankers, refining and drilling equipment. Esso Touring Service people and others were answering questions and passing out booklets.

I remarked to one of these people that all this must take a lot of planning and preparation. He agreed.

"Getting ready for this meeting has meant a lot of work for a lot of people," he said, "but we think it's worth it. We want to encourage stockholders to come to the annual meeting. One way is to make things as convenient as possible for them.

"We used to hold annual meetings in Flemington, New Jersey. But by 1949 there was no building there big enough to hold our crowd. We had to set up a circus tent.

"Last year we moved in here. Had a good meeting, but the acoustics were bad. Two days after the meeting we went to work on that. We've put in sound insulation, and the acoustics are good now.

"We think it's better to have the meeting on company property than outside. It gives stockholders a chance to see some of the plant they own an interest in and to meet more of the company people."

One of a platoon of pretty girl ushers led

BOILER SHOP

me to a seat. She handed me a copy of Jersey's annual report for 1950. Then she explained what to do if I wanted to speak during the meeting.

All I had to do was stand up, she said. Then she would signal to the chairman that someone in her section, containing maybe 150 people, wanted the floor. When the chairman recognized me, a man would hand me one of the fourteen portable microphones which were distributed about. Then I could start talking.

Just then the chairman rapped his gavel to open the meeting.

Mr. Abrams welcomed us and smoothly got the meeting under way. Next, Eugene Holman, the president, talked about what the company had done last year and what it hoped to do this year. Then came the first request for questions and discussion from the floor.

The system worked fine. When a stockholder got to his feet, the usherette in his section raised a big cardboard disc fixed on the end of a stick. One side of the disc was white, the other yellow, but the number of her section appeared on both sides. Now she held the yellow side toward the platform, so that the chairman could see it.

When the chairman recognized the stockholder, the usherette turned her stick around so that the white side of the disc was toward the platform. This was the signal for a watching sound engineer to cut in the microphone serving that section. The stockholder was then handed the microphone, and could speak his piece.

Only one stockholder had any difficulty. He held the microphone to his ear. Naturally, nothing came out of the loud-speakers. The chairman straightened him out by inquiring pleasantly if he were used to being on only the receiving end of conversations.

Before the meeting was adjourned, a total of seventy-two questions, suggestions or remarks had come from the floor, in addition to laughter, applause and sounds of disapproval aimed at people deemed to be talking too long.

A good deal of explanation or discussion followed some questions by stockholders. Mr. Abrams himself acted as the company's spokesman much of the time. Occasionally he called on other officers or directors for comment.

At 12:42 p.m. I heard Mr. Abrams say, "I am going to declare a recess for lunch, if you don't mind."

Now I discovered what was behind the backdrop: long tables; chairs in front of them; and on the tables sandwiches, beverages, fruit and ice cream.

After lunch, many stockholders, of whom I was one, elected to go on a tour of the Esso Research Center. We went at intervals during the afternoon in busses dispatched and controlled by traffic men using walkie-talkie radios. In small groups, guided by employees of Standard Oil Development Company, we inspected the enormous new workshop of this central research and engineering organization of the Jersey companies.

We saw a demonstration of a refining process called fluid solids cracking. We watched a crew make an inner tube from Butyl rubber. We smiled at a pretty girl modeling an all-petroleum outfit from hat to shoes. We heard how special-purpose oils and greases are tailored. We looked at an exhibit of insecticides, weed killers and cattle sprays.

Back at the boiler shop, the meeting adjourned, at 3:08. The official stenographer's typed transcript filled 109 pages.

A few other things that happened, and some that did not:

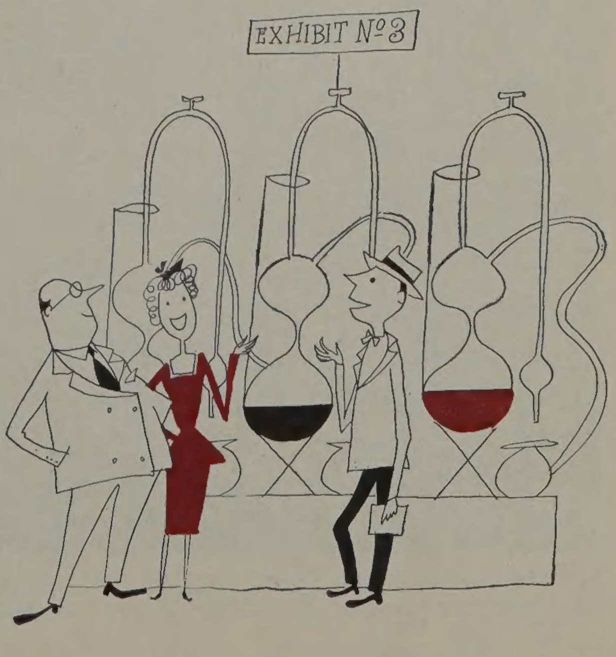
Esso Touring Service had 300 requests for information and gave away 650 maps.

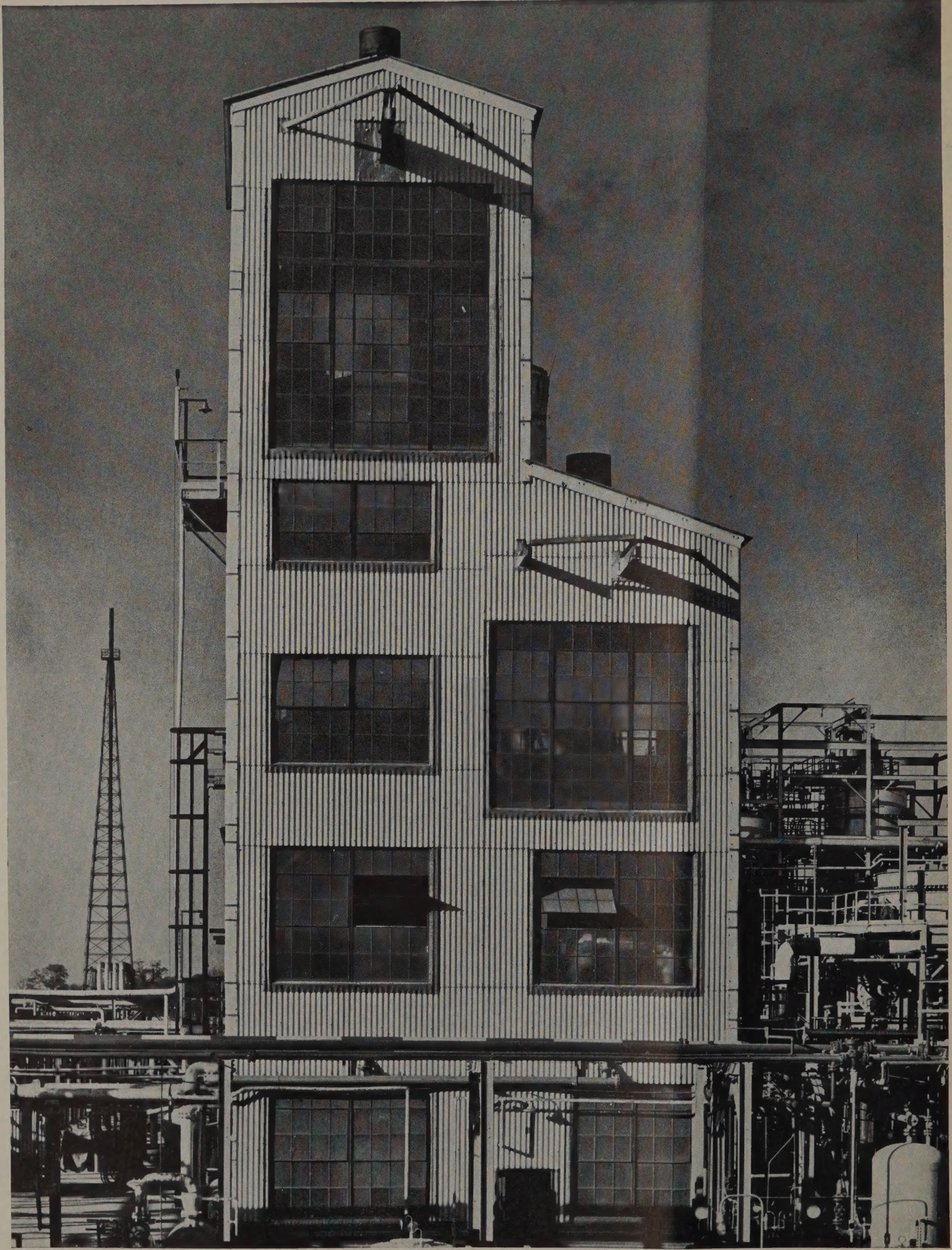
The lost and found booth was peaceful. One earring was lost, found, returned to its owner.

Movies were shown to the bus drivers when they were not busy driving.

A lady stockholder, during her tour of the Research Center, tripped and appeared about to fall. She was caught, and spared this mishap by, of all people, the head of S.O.D.'s medical department.

It was enough to make a fellow walk away shaking his head.





A BIG STILL inside this building at Esso Standard's Baton Rouge refinery produces ethyl alcohol. Baton Rouge's large chemical products division uses refinery gases as raw materials

QUIET REVOLUTION

At the chemist's touch, petroleum yields a widening variety of new synthetic materials

Editor's Note: *In its June issue,* The Lamp *discussed economic aspects of petrochemistry, the science that makes chemicals from petroleum. This article considers some of the steps by which this new industry is producing a fantastic range of synthetic materials.*

THAT transparent, lightweight raincoat hanging in your closet may well have come out of an oil well; also the nonbreakable icebox dishes that hold leftovers in your refrigerator, the gaily colored hose in your garden, the washable curtains in your bathroom, the enamel on your kitchen range, the wrapper on that frozen spinach and many thousand other articles that have become commonplace today.

It is petrochemistry—the science that is having such a remarkable impact on the American economy these days—that converts petroleum hydrocarbons into these contributions to modern living.

Crude petroleum itself would be a prolific and obvious source of these hydrocarbons except for one fact: the various combinations of hydrocarbons in liquid oil are so complex that their separation is not easy. However, natural-gasoline plants in the oil fields normally turn out quantities of the gases propane and butane in almost pure state; and refinery processes yield the gases ethylene, propylene and butylene, likewise ideal hydrocarbons for conversion into synthetics.

The hydrocarbons of these gases, when combined with other elements such as sulfur or oxygen or chlorine, become different chemicals entirely. These products are not only usable in their new forms, but they also become intermediates in the making of totally new molecules by the process known as polymerization.

Polymers are super-molecules that have been built up out of lesser molecules. In their transition from relatively simple structures to complex ones, polymers take on new physical characteristics that frequently never were available for man's needs before.

The art of making polymers has progressed even though chemists are not always certain of precisely what goes on when they react different molecules to produce a polymer. They know that certain chemicals undergo certain changes in the presence of catalysts—substances which promote reactions that otherwise could not take place, yet remain unchanged themselves. Despite numerous theories, in many of these reactions it is not known precisely how or why the hydrocarbons rearrange themselves.

Once a catalyst has been selected, the making of a polymer is a matter of temperature, catalyst concentration, time and pressure. For example, you could start with the ethylene molecule, a combination of hydrogen and carbon atoms, and replace the hydrogen with fluorine. A chemical called tetra-fluoroethylene results. When this product is exposed to the right catalyst under proper conditions of temperature and pressure, a highly complex molecule is formed.

This is a polymer, unlike any molecule nature ever invented. Its trade name is Teflon, and it is an extremely inert plastic used especially for enamels and electrical insulation. By varying the number of atoms of hydrogen and carbon, and substituting other chemicals for fluorine, the chemist can make thousands of those useful materials which are referred to as plastics.

AT every stage in chemical procedure, from the basic reactions to polymerization itself, the chemist finds himself with more kinds of molecules on his hands than he has any use for immediately. That is, the desired chemical product rarely uses up all the compounds that the chemist pours into his stew. Usually there are by-products to a chemical reaction, particularly if it is a complicated one. A company planning to enter some phase of petrochemistry thus must look ahead to determine what it can do with its by-products. Since further reaction of the by-products produces in turn still more by-products, petrochemical plants sometimes find themselves being wagged by a very long tail indeed.

Consider, as an example, the experience of Celanese Corporation of America, one of the nation's biggest makers of rayon fibers. On 1,200 acres near Bishop, Texas, the company has built a plant on the grand scale typical of petrochemistry. It has 101 fractionating towers lined up like sentinels; it reacts 175,000 gallons of butane and propane a day, requiring almost 5 million gallons of water, 25,000 kilowatt hours of electricity and 35 million cubic feet of natural gas for fuel each day. The purpose of this large layout is to convert propane and butane into acetone and acetic acid, which are shipped to the company's plants in the East to be made into rayon fibers.

The process of Celanese is fairly simple on a flow chart. Butane and propane, the raw materials, are treated with oxygen and with hydrogen. Half the plant's output consists of acetone and acetic acid, the base chemicals in the making of rayon. The other half of Celanese's production consists of fifteen other chemicals not directly related to the rayon industry. These fifteen by-products are sold on the open market.

E. I. du Pont de Nemours & Co., Inc. has a prime interest in petrochemical developments. In its plant near the Sabine River, south of Orange, Texas, the company starts one process with cyclohexane, a liquid obtained from petroleum. Half this cyclohexane du Pont buys from a refinery, the rest it makes itself from benzene—which used to be derived entirely from coal tar, but now comes also from petroleum. A series of chemical tricks converts the cyclohexane into nylon salt dissolved in water. This solution is shipped East, where it is spun into nylon fiber.

Du Pont also subjects natural gas to reaction with steam, then compresses the resulting gases and passes them through a catalyst to form methanol—an anti-freeze for your automobile radiator and a raw material of formaldehyde, which is a base chemical in many industries, particularly the manufacture of synthetic resins. Du Pont also converts propane gas into a tricky polymer that makes a heat-and-cold-resistant film to wrap frozen foods and can also be molded into drinking "glasses."

Some of the synthetic fibers that you will be wearing next year will come from a totally new process. Monsanto Chemical Company is building, at Texas City, a plant that will convert natural gas into acrylonitrile, which is a base for many new developments in synthetic textiles.

The interrelationship of the petrochemicals is neatly illustrated by the operations of the Dow Chemical Company at Freeport, Texas. Dow cracks propane and butane into two gases, propylene and

ethylene. Some of the ethylene becomes ethylene glycol, which is not only a permanent-type radiator anti-freeze but also an intermediate in the making of industrial solvents, insecticides, synthetic detergents and fumigants.

The rest of the ethylene becomes ethylene dichloride, foundation of vinyl chloride, which makes a plastic that is used for textile fibers and packaging films. The Ethyl-Dow Corporation makes ethylene dibromide, a component of Ethyl fluid, which keeps car engines from knocking.

The propylene stream at the Dow plant becomes propylene glycol. You smoke it, for it is a moistening agent in tobacco. You eat it, for it moistens coconut, it is a solvent for drugs and food flavors, it helps to retard mold in bakery products.

The end products of petrochemistry are usually developed among a number of plants, each doing the part of the process for which it is best adapted. Thus, Humble Oil & Refining Company, in its refinery at Baytown, Texas, and Esso Standard Oil Company at Baton Rouge, Louisiana, convert isobutylene into a polymer of high molecular weight called Butyl, the synthetic rubber now used to make most inner tubes and potentially useful in a number of other products.

In addition, these companies also make large quantities of butadiene that is sent by pipeline to a nearby rubber manufacturer to become another synthetic rubber, GRS. And, by a process so precise that engineers must control temperature to a quarter of a degree, the Humble company produces cyclohexane, which is shipped by barge to the du Pont plant at Orange to be made into nylon salt.

The step-by-step development of one chemical into another shows up neatly in the case history of isopropyl alcohol, which Esso Standard Oil Company made at Bayway, New Jersey, as early as 1919. At that time, the alcohol was wanted primarily as a base for acetone, which was needed for the "dope" used on airplane fabric. Later, acetone also was needed for rayon.

The Esso people began to produce isopropyl alcohol in quantity, and then started looking for further uses for it. They pushed the product as a supplement to the nation's supply of grain alcohol for industrial purposes. It took hold; today the country uses 130 million gallons of isopropyl alcohol a year.

More importantly, the development of isopropyl alcohol showed Esso's chemists the way toward other uses for refinery gases. Along came secondary butyl alcohol, which now is converted into a potent solvent called MEK (methyl ethyl ketone). MEK is an important chemical in many fields, particularly in the lacquer, coating and resin industries.

Still another alcohol to be synthesized was ethyl alcohol. Today, more than half of the nation's output of this basic industrial material is made from ethylene gas, thus conserving grain or releasing black strap molasses for cattle feed.

The acetate rayon draperies in your living room or the film in your camera may have been made in part from ethyl alcohol derived synthetically from petroleum. Every year, Tennessee Eastman converts millions of gallons of ethyl alcohol into acetic acid which, in combination with cotton linters or wood pulp, forms rayon yarn and a host of plastic materials.

Sometimes creation of a synthetic sets up problems totally unforeseen, as in the case of the synthetic detergents. Glycerin has long been a by-product of soap-making. When synthetic detergents began to check the expansion in soap production, it appeared that the nation faced an acute shortage of glycerin, which has wide use in industry. But then chemists learned how to make glycerin itself synthetically.

Usually one chemical development leads to another. In the early 1930's, chemists of Esso Standard Oil Company, working on synthesis of alcohols, produced isobutylene as a by-product of little value. Their colleagues dug into the matter, and came up with a use for isobutylene that has altered the gasoline business greatly. They combined isobutylene with itself to form di-isobutylene, and then added hydrogen to produce iso-octane—the start of high-octane aviation gasoline.

THESE days the trade journals frequently carry advertisements asking if anyone has an idea of what such-and-such a chemical product might be used for. This pressure on chemists to find new uses for ever more synthetic products has produced thousands of new articles, including even edible fats. As new synthetics appear, they are seized quickly by other industries for working into final products—and then these other industries find themselves hiring chemists to improve their wares. More chemists work outside the basic chemical industry than in it.

Moreover, many synthetics, in large quantities, are going into the tools of defense. The products from most chemical plants are adaptable, and can find uses in war as well as in peace. In petrochemistry, the armed forces have a mighty ally.

All this phenomenal progress of petrochemistry has been achieved in a few recent years by what might be called the traditional methods of chemistry, involving the rearrangement of atoms to make strange new molecules. Ahead lies the wide-open, fabulous field of nuclear chemistry, which plays with the atoms themselves. Already the star-gazers among chemists are looking in that direction.

ARCHITECTURE OF THE ROAD

THE development of the modern highway system has brought to our landscape new and exciting forms of architecture. Ordinarily, the function of architecture is to enclose space within structure. The function of the architecture of the highway, however, is to facilitate movement on a single plane, to cut through space instead of enclosing it.

Everywhere we drive, this dynamic quality of highway architecture is apparent in shapes of stone and concrete and steel. Multiple-level ramps climb and fall away as we approach the modern bridge. At highway intersections, the roadway flows smoothly through the intricacies of the cloverleaf or soars gracefully across an arching overpass. Yet these forms and others which we have created to help us move swiftly and easily from one place to another have become so commonplace, so familiar that we rarely recognize their beauty. It is only when they are held fast in pictures that we become aware of what handsome structures they are.

Working in the metropolitan New York area where such forms of highway architecture exist in greatest concentration, Artist Fletcher Martin has captured their vigor and beauty in paintings that appear on the following pages.

GRACEFULLY CURVED RAMPS carry traffic to and from street level at the Bronx end of the Triborough Bridge. The elevated highway takes through traffic. These approaches, which have a very high traffic density, are successfully contained in a rather limited area

THE NEW TUNNEL to Brooklyn from the Battery uses depressed rather than elevated roadways to avoid cross traffic on its approaches

THE RHYTHMIC CURVES of the familiar clover leaf, separating grades at intersections, are seen at this junction of Westchester parkways

STEEL ARCHES support an overhanging curve on Riverside Drive. This old structure is bulkier, though no stronger, than more modern types

STONE-FACED BRIDGES like this one on the Taconic Parkway are typical of overpass structures on the parkways in the New York area

THE UNADORNED STEEL TOWERS of the George Washington Bridge are stately in their simplicity. Originally they were to have been encased in granite. Their great bulk is in striking contrast to the slender steel deck of the bridge

THE NEW JERSEY ENTRANCE of the Lincoln Tunnel, with its extensive use of stone, has beautified the hillside area. Its most unusual feature is the long spiral approach (background) descending the western flank of the Palisades

AND NOW, THE JERSEY TURNPIKE

ONE day next January, some motorist will turn off U. S. 46, near the New Jersey end of the George Washington Bridge over the Hudson, and set sail to the southwest. Two hours and 118 miles later, he will leave New Jersey via the spectacular new Delaware Memorial Bridge, just below Wilmington. He will not even have paused en route.

If the motorist has previously agonized across the state on existing highways, his first voyage on the New Jersey Turnpike may have a certain dreamlike quality. He may fear to wake and find himself trapped, after all, in the choking traffic of U. S. 1 or 130.

The Turnpike, happily, is no dream. It is the nation's newest express highway, designed to be the best that could be built, constructed in the record time of two years. When its southernmost 108 miles are opened to traffic on November 15, there will be nothing else quite like it.

From its northern terminal near Ridgefield Park to its southern end at Deepwater, it unrolls like a fantastic strip of tape, without a single grade crossing, drawbridge, traffic signal, left turn or other impediment to fast, safe motoring.

It has four, sometimes six, traffic lanes. Between northbound and southbound lanes is a dividing strip from 10 to 84 feet wide, except on four large bridges where it is narrower.

Its steepest hill has a mere 3 per cent grade (three-eighths of an inch to the foot). Its sharpest curve has a 3,000-foot radius (that is, if the curve were extended until it formed a circle, the circle would measure 6,000 feet, well over a mile, across).

On the other hand, there is no straightaway longer than three miles. Many apparent straightaways actually are gentle curves about 10,000 feet in radius. These are designed, by requiring the driver to use pressure on his steering wheel, to keep him from being lulled into unawareness of his high speed—a dangerous phenomenon safety experts call "velocitizing."

To the outside of the traffic lanes, the motorist will find shoulders 16 feet wide (10 feet paved). The paved inside shoulders measure 5 feet.

Shoulder paving differs in appearance from traffic-lane paving. If a driver, nevertheless, wanders onto an inner shoulder, toward the dividing strip, he will discover that the strip or mall is gently sloped to guide him back where he belongs.

This majestic, boldly conceived thoroughfare will be something for future highway builders to aim at. Yet a mere two years ago, in early September of 1949, the year-old New Jersey Turnpike Authority was not even sure it was going to build a turnpike.

Before that month was out, however, work on it had actually begun. Though at a cost which soared as high as $8 million a mile, the Authority successfully negotiated a route through the industrial complex of northeastern New Jersey—an appalling tangle of railroad lines and yards, big manufacturing plants (including Esso Standard Oil's Bayway refinery) and public utilities, already crisscrossed by trunk highways as well as local roads.

Efficiently and with uncommon tact, the Authority acquired about 3,500 parcels of real estate with less than 300 condemnations. It moved or demolished some 450 buildings and helped hundreds of dispossessed tenants find new places to live.

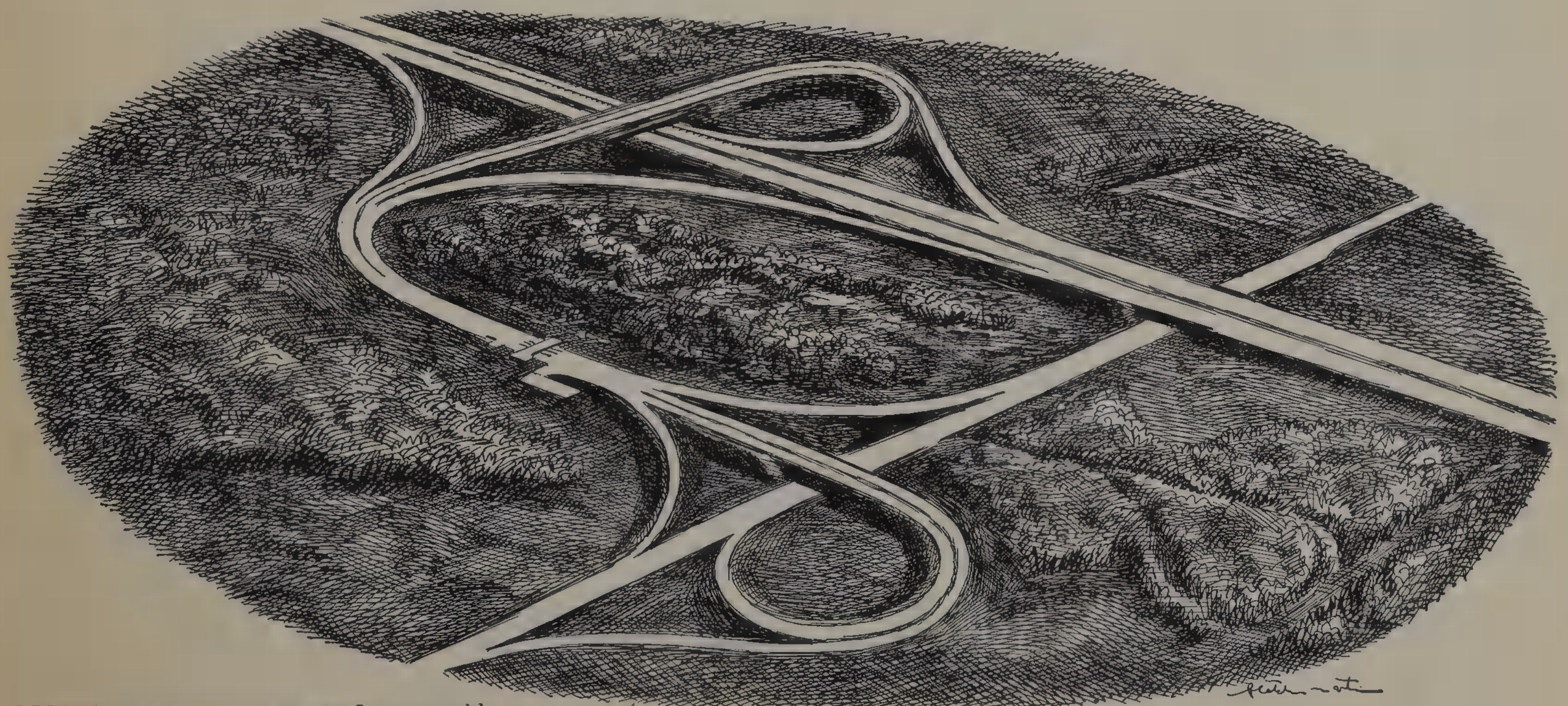
The gravest threat to the Turnpike's tight construction schedule arose in the summer of 1950 and haunted it for a year. The national emergency began to cause material shortages and to make allocations necessary. What about the 188,000 tons of steel for the Turnpike's bridge structures and guard rails, its piles and reinforcing?

Now the Authority's bold decision, the previous autumn, to start work without wasting a day appeared as a stroke of genius. For all its steel was ordered; much, in fact, was already fabricated.

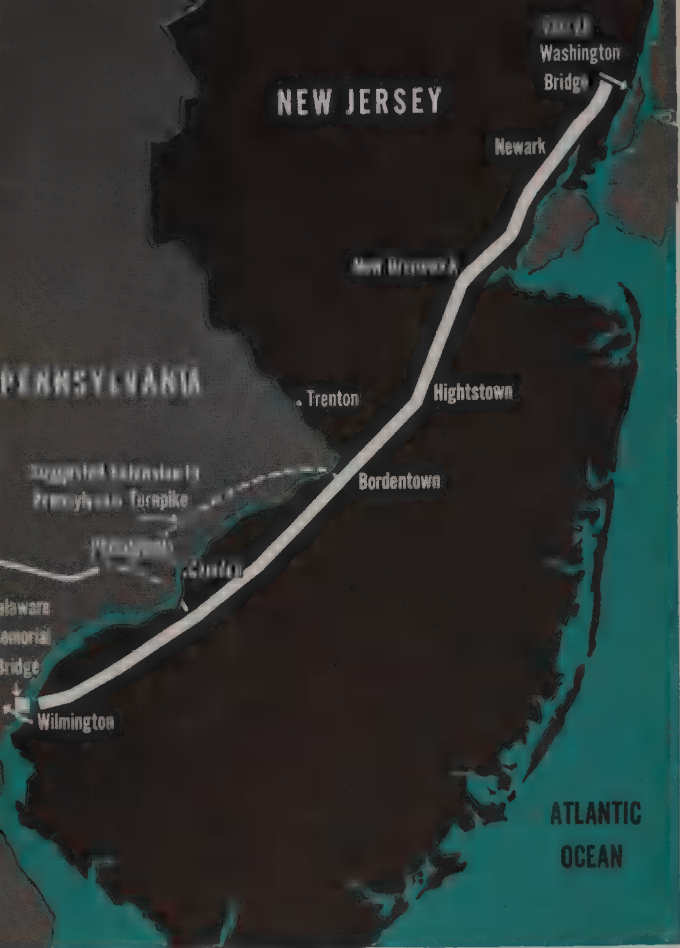
Late deliveries still cost its engineering staff and its contractors sleepless nights, but the only critical occurrence was failure to receive steel for the Passaic River bridge. This has forced a postponement, estimated at two months, in opening the northernmost ten miles of the Turnpike.

The urgency back of this tense effort to build a road sprang from the desperate conditions on the state's highways.

A postwar survey reported that immediate highway needs would cost the state $600 million. To raise anything like that amount for roads by taxation or a bond issue proved, as it has in other states, politically impossible. New Jersey then



EIGHT TRAFFIC STREAMS flow smoothly through one toll gate at the Camden interchange



NEW JERSEY TURNPIKE, 118 miles long, was designed for fast, safe, non-stop driving

turned, as a number of states have recently, to the creation of an independent agency, a kind of public corporation, to finance trunk highways by the sale of revenue bonds to private investors.

There was no doubt what the Authority's first project had to be. To motor between New York and Philadelphia, roughly 100 miles, required four hours (always provided that traffic was merely normal). An expressway would provide a fast route across this corridor for through traffic, while making conditions on parallel highways tolerable for local traffic. Eventually, it would connect, via spurs, with the Pennsylvania Turnpike on the west and the New York Thruway to the north.

The Turnpike would have to attract enough business to pay for itself, because the Authority was empowered to sell bonds which constituted a claim only against future Turnpike tolls, not against the state of New Jersey.

In this respect, the circumstances were favorable. The Turnpike follows one of the busiest truck and bus routes in the world, and most commercial operators will find it profitable to pay the tolls. They will cut their running time heavily and reduce fuel and maintenance costs while doing so. They will pay, according to a tentative schedule of tolls, up to 3½ cents a mile, depending on the size of the vehicle. Passenger cars will pay about 1½ cents a mile.

More than 8 million vehicles are expected to use the Turnpike during its first full year of operation. At this rate, the revenue bonds, totaling $220 million, looked like a sound investment to the fifty-two private institutions, most of them insurance companies, who now own them.

The Turnpike could not have been built in two years if construction had started, conventionally, at one end and proceeded to the other. Instead, the route was divided into seven sections, and a different engineering firm was placed in charge of operations in each. The entire project involved seventy-six major contracts and about half that number of miscellaneous contracts.

The chain of command by which contractors and engineers are supervised and their jobs dovetailed leads to the Turnpike Authority's offices in Trenton. Here it passes over the desk of Commander Charles M. Noble, the Authority's red-headed, cigar-smoking chief engineer.

As an ex-Seabee officer and a veteran also of the building of the original Pennsylvania Turnpike and many of the Port of New York Authority's bridges and tunnels, Commander Noble has had construction headaches before. This, no doubt, is what enables him, whether at his desk or touring the hot spots on the job, to remain an island of notable calm amid a storm of flying blueprints, emergency conferences, landowners voicing grievances and distress calls from contractors. These, it appears, are things you can't build a superhighway without.

The human problems in building the Turnpike, in Commander Noble's opinion, have been greater than the engineering problems. Certainly there have been more of them.

In the city of Elizabeth, for example, most of the 240 buildings which stood in the Turnpike's right-of-way were houses about fifty years old. They were generally undesirable as dwellings, but this did not help their 100 owners and 235 tenants find new housing at a cost within their means. To aid them, the Authority even bought vacant lots in Elizabeth and moved to them twenty-five of the better houses originally scheduled to be torn down.

Near Secaucus, an occupied house stood squarely in the middle of a Turnpike bridge site until last June. The Authority had long since bought the property. But the woman occupant was a party to a pending divorce suit. Until she was assured of a satisfactory property settlement, she intended to keep her old roof over her head.

"We could have put her out," Charley Noble reflects. "We had the power. But she was a woman with children. It wouldn't have been a good thing to do."

Fortunately, the lady departed under her own power before the bridge building had been seriously delayed.

In rural areas, the Authority found itself the proprietor of considerable farm acreage, which it will put on the market as soon as more urgent matters are disposed of. This came about because the Turnpike cut a good many farms in two. It often appeared cheaper, in the long run, to buy a farm than to build the owner a private overpass to his south forty.

Utility lines had to be carried across or under the Turnpike's right-of-way at many points. Sometimes this was complicated and costly work. So the Authority was happy to note, in a central New Jersey county, that the Turnpike route very nearly followed the line dividing the territories of two power and light companies.

With no trouble at all, it negotiated an agreement between the companies to exchange a handful of customers, so that neither company's lines would cross the Turnpike. Only then did it learn that some customers declined to be exchanged. They were, they said, devoted to their old companies. The Authority offered them compensation, and was relieved to find that their devotion was measurable, after all.

ONE of the biggest engineering problems was how to build a stable embankment on the deep, quaking mud of the Jersey meadows.

The meadows, so called, are the four-mile-wide swamp through which the Hackensack River meanders for some nine miles, west of the Hudson River Palisades, down to the head of Newark Bay. Once, geologic ages ago, the Hudson flowed here instead of in its present channel. It left behind a vast deposit of silt which normally holds quantities of water but dries to a powder as fine and smooth as talcum.

The engineers' test borings showed 100 feet or less of this silt over most of the route. But in one spot, not far from the Lincoln Tunnel entrance, they penetrated 210 feet of it before finding hard bottom. (They also found that cedar trees once flourished on the meadows; their tough, rot-resistant stumps, among the roots of today's tall reeds, are as hard to cut through as anything short of rock.)

Where the Turnpike was to cross bridges on the meadows, steel piles were driven clear through the silt to support the structures. But this type of construction is too expensive to be used when not essential. Most of the meadow crossing was to be on an earth embankment.

The trouble was that the embankment would necessarily settle, some places as much as ten feet, as its weight pressed water out of the silt below. The problem was to make it settle in a hurry; unaided, the process would take years.

First, the amount of settlement was carefully calculated for every yard of embankment, considering the depth and consistency of the mud and the weight of the permanent fill and road surface.

Then, as the embankment was commenced, steel tubes were driven through and alongside it. The tubes were filled with sand, and the steel then withdrawn. As the embankment rose, water squeezed from the silt flowed into the columns of sand, was forced to the surface and drained harmlessly off.

Altogether, almost 5 million linear feet of these sand drains, each 14 to 20 inches in diameter, were built.

To make sure that settlement took place at a steady but moderate rate, gauges were sunk into the mud to measure the pressure at various depths. If, for instance, the pressure rose too rapidly, fill would be added more slowly for a while.

Finally, what the engineers call an overload was placed on the fill. That is, the embankment was built higher than its permanent level, in order to add weight and thereby hasten settling. When settlement was complete, the overload was removed.

From its northern terminal at U. S. 46, the Turnpike sweeps four miles southward over the meadows to the Lincoln Tunnel interchange, the first of fourteen points, in addition to the two terminals, where vehicles may enter or leave.

Just beyond, it passes Secaucus. Here, the Turnpike has performed an incidental service by acquiring much of the property once devoted to pig farms of air-borne fame in that region.

Past Secaucus, it turns westward and begins to rise for its lofty crossing of the Hackensack, cutting, as it does so, through a shoulder of Laurel Hill, an eccentric rocky outcrop rising weirdly out of miles of marshland.

Across the Hackensack, the Turnpike curves south again, bridges the Passaic River and ducks down to pass under the Pulaski Skyway, carrying U. S. 1 and 9. A second interchange is located near here, seven miles beyond the first.

Then for some seventeen miles the Turnpike knifes through the dense industrial area bordering Newark Bay and Arthur Kill. For five of these miles it is built on top of 6 million cubic yards of sand dredged from the bottom of the Atlantic Ocean, barged to Port Newark, mixed with water and pumped through pipelines to the right-of-way.

THERE are Turnpike interchanges at Newark Airport, at Elizabeth, at Carteret, two near Woodbridge. Then, nearing the New Brunswick interchange, the Turnpike emerges into open country. For its remaining eighty-three miles, except for a stretch near Camden, it cuts a swathe through gently rolling farmland.

Here the interchanges are farther apart—Hightstown, Bordentown, Burlington, Camden, Woodbury and Swedesboro. At intervals of a mile or two, the local roads cross the Turnpike on severely handsome, functional overpasses.

Approximately ten miles apart are service-station and restaurant sites, well back from the traffic lanes. Until the volume of business warrants, however, each service site will be completed on only one side of the Turnpike, so that the motorist in either direction will find them at twenty-mile intervals.

Some of our highways have become overcrowded soon after completion, because the builders could not visualize the staggering increases in traffic volume which did, in fact, occur. Other highways have suffered under heavy traffic, usually because the subsurface was inadequately drained. The New Jersey Turnpike seems safe from both these misfortunes.

Plans are all ready for the addition of two traffic lanes, one in each direction, from the Camden interchange northward. In addition, the 250- to 300-foot right-of-way, the whole length of the Turnpike, could accommodate even more lanes if they should ever be required.

The Turnpike seeks patronage by trucks. It will withstand 36,000-pound single axle loads, and definite provisions have been made to prevent water and frost from getting into or under the pavement.

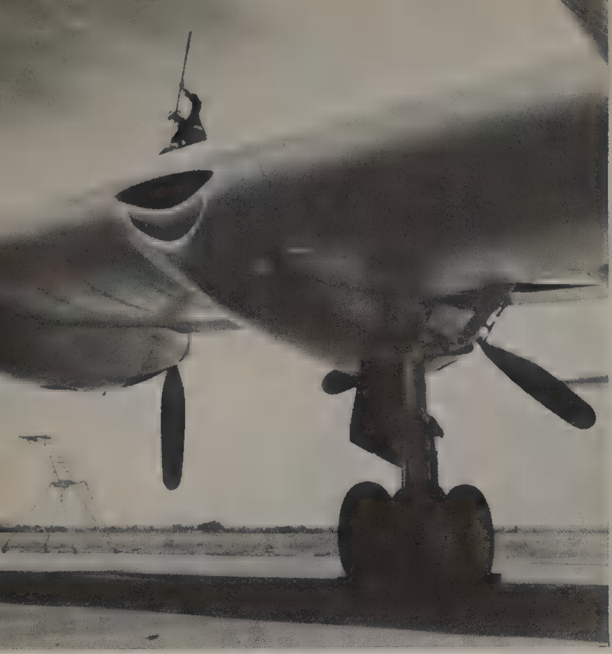
The earth embankment on which the paving is to be laid is first compacted under 50,000-pound axle loads. On top of the embankment are placed layers of sand totaling 21½ inches in depth. Next come 6½ inches of stone. Then 7½ inches of penetration macadam—stone and asphalt. Finally, the wearing surface, of hot-mix asphaltic concrete, 4½ inches thick.

Something like 35 million gallons of asphalt, much of it supplied to paving contractors by Esso Standard Oil Company, are being used on the Turnpike. The asphalt surface will contain enough stone to give it a gritty texture and make it as skid-proof, in all weather, as a highway can be.

Today the Turnpike builders are hitting the home stretch—paving, completing toll gates, service areas and access roads, preparing signs and highway markers.

Commander Noble, with the assurance of a man who has done all this before, has no doubt how the job will wind up. "On November 14," he predicts, "we'll be in one hell of a mess. On November 15, we'll be open for business."

ASPHALT, some 35 million gallons of it, is being used on the Turnpike. The black surface will contain enough stone to give it a gritty texture and make it as skid-proof as a highway can be



FLIGHT ENGINEER

He commands speed and coaxes mileage from the biggest power plant ever put in a plane

IN a modest frame house on a side street of Fort Worth, Texas, lives a quiet young man named Russ Stokum. Stokum's distinguishing mark is his occupation. He is flight engineer of a B-36, the mightiest warplane man has ever put into the air, one that can carry its bomb load anywhere on the globe and return to friendly territory without refueling. In Stokum's hands is the power control that gets B-36 Number 058 to its destination and back.

When Number 058 takes off from Carswell Air Force Base in Fort Worth, headquarters of the Eighth Air Force, its six piston engines and four jets are putting out as much power as nine locomotives. It takes lightning mathematics in flight, plus a nice feel for the control of six 3,500-horsepower engines, to deliver a bomb load 5,000 miles from home and have enough gasoline left to make the return trip. From take-off until Number 058 begins its landing descent, Stokum is sole boss of this great power plant except when the pilot uses his jets to gain altitude or airspeed quickly.

The aircraft commander (first pilot) steers the ship; the pilot (who used to be called co-pilot) maintains altitude; the flight engineer balances altitude, power, weight, weather, aircraft behavior, precision of the pilots' flying—and comes up with the exact airspeed demanded from minute to minute to follow a flight plan. He must maintain the speed of this air Goliath (which can weigh 358,000 pounds loaded) within a mile an hour of a pre-set plan, through any kind of weather.

Like most flight engineers of the B-36's, Second Lieutenant Russell L. Stokum entered his highly specialized profession by accident. He was born thirty-two years ago on a farm on R.F.D. #1 outside the town of Export, Pa. While his father worked as a coal miner, Stoke (his inevitable nickname) and his six brothers and sisters tilled the family's forty-two acres. Finally, after graduation from rural Franklin Township High School at near-by Murrysville, Stoke got a job on a dairy farm.

War took Stoke off the farm. He enlisted in the Air Corps, and subsequently he flew thirty-five missions from Guam as flight engineer on B-29's. Master Sergeant Stokum, bearing the Air Medal with three clusters and the South Pacific medal with two clusters, returned to this country and decided to "stay in." That decision was concurred in by Miss Nadine R. Wood, a farm girl from near Beaumont, Texas, who later became Mrs. Stokum and the mother of two daughters.

The B-29's that Stokum flew in the Pacific were, as we see them now, rather simple pieces of machinery. Their flight engineers were essentially no more than master mechanics. But then came the B-36, the biggest airplane now in assembly-line production anywhere—a plane designed to carry tremendous bomb loads great distances; a plane intended to carry enough fuel to made its way back to a friendly base from any hostile zone; a plane so well armed that, theoretically, no fighter plane could get close enough to down it.

THE B-36 was also the world's most complicated airplane. It had such an array of controls that they wouldn't fit on the panel facing the two pilots; indeed, no two pilots could have used them all and still had time to fly the plane. And so the hundreds of dials, circuit breakers, hand controls, switches and signal lights were placed on a group of panels behind the pilots, and a seat was installed there for a flight engineer. For the first time, the engineer alone was to control the ship's power.

When the first of the B-36's was being prepared for delivery at the plant of Consolidated Vultee, adjacent to Carswell Base, the generals of the Strategic Air Command realized what a big bird they had on their hands—a $3,500,000 piece of machine and gadgets of war. It was clear that it would need to be handled by crews more mature, more conservative than the wild-blue-yonder lads of World War II. Five men who had shown the right spark as crew chiefs and flying mechanics were picked to check out as the first flight engineers on the B-36. One of these men was Stokum—the short, slim, dark-haired, serious-looking farmer from Pennsylvania.

Like the rest of the crewmen of the 36's, Stokum has given his prime allegiance to the Eighth Air Force ever since. Today the Eighth is on a wartime alert even while it is subjecting its flying personnel to a rigorous program of schooling. When he is not in the air, Stoke either attends classes to make him an even better engineer, or instructs new flight engineers, or fusses about Number 058, the ship in which he flies. There are no regular days off among the heavy-bomber crews.

Where do all these frantic labors end up? Lieutenant General Curtis LeMay, the head of the Strategic Air Command, says that the B-36's are ready now to operate anywhere in the world. Major General Clarence S. Irvine, who is Stokum's boss as commander of the 19th Air Division at Carswell Base, says his men can drop a bomb within a breathtakingly close distance of a target from an altitude of 40,000 feet. They do it regularly on simulated war missions.

Come along on a flight aboard Number 058—one of the fabulous long-range journeys for which the B-36 was designed.

You'll have to get up early for this one. The phone is ringing at 4 A.M. in the Stokums' home. "Briefing at 0600 hours," a voice says, "for an M.E. formation flight." Stoke is instantly alert; the message tells him that at 6 A.M. he must be in the Seventh Bomb Wing's headquarters to learn about a Maximum Effort flight. "M.E." means "all out" to B-36 crewmen. "This'll be a big one," Stoke tells his wife.

Stoke takes his seat in the large, air-

conditioned briefing room with the other crewmen who will fly this mission. The lights snap off, and an illuminated map of the continent glows across the front wall. The briefing officer speaks tersely, following his comments on the map with a pointer.

"You will start taking off at 1700 hours, leaving Carswell at three-minute intervals. Each plane will follow a different route at a different altitude, as outlined in your flimsies. If you follow orders exactly, you will find yourselves in battle formation over Chicago. . . ."

That's not a game of chess the generals are playing. They want to know whether they can plot a mass flight so precisely that squadrons of B-36's can approach a target by scattered routes and arrive at a gathering point on time for a formation attack. That way they'd have a better chance of evading an enemy's coastal radar defenses.

". . . . After radar bombing of your target in Detroit, you will reduce altitude to 25,000 feet and cruise in formation to Spokane. . . . You will go up to 38,000 feet for approach to your next I.P., which is Sacramento. . . ."

"I.P." means Initial Point for the bombing run—a landmark that will be evident to the navigator through his radar. From the I.P. the planes will proceed to . . . .

". . . . San Francisco. After that run, you will come down to 18,000 feet. . . ."

The flight engineers understand about the sudden changes in altitude; they provide practice in cruise control under differing conditions.

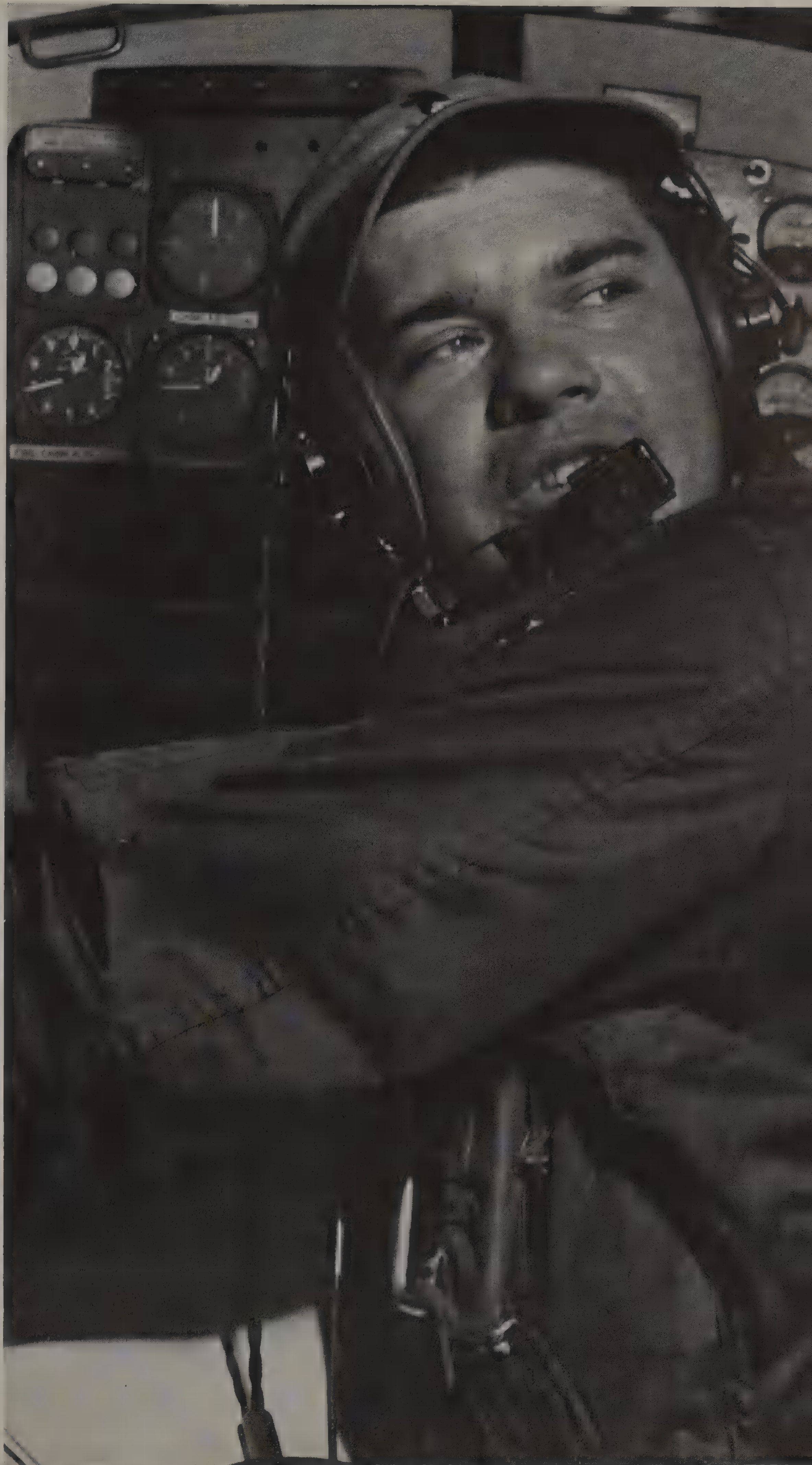
". . . . and at 36,000 feet you will be approaching the target range in New Mexico for live bombing. Better be sure you check in with the guy in the control tower there. We want to give him time to collect his chickens off the range. Then you'll head straight for Memphis, where the target is. . . ."

Stoke does some rough figuring. It looks like a thirty-two hour trip, this time.

"You will take off in clear weather. Some scattered cumulus at ten thousand, that's all. Lots of thunderstorms around Fargo. Heavy overcast along the West Coast. You'll hit it really bad as you approach Memphis, where a cold front is due to . . . ."

M.E. flights always run into nasty weather somewhere. The B-36 is supposed to dash in over enemy territory behind the cover of storms. That confuses the fighter opposition.

At 4 P.M., after Stoke has completed his pre-flight examination of the ship, the crew lines up beside Number 058 for inspection by the aircraft commander. The sixteen men—in flight suits, with parachutes bulky on their backs—climb narrow ladders to the fore and aft compart-



FLIGHT ENGINEER Russ Stokum turns from his instrument panel to speak to the pilot on the intercom. In the picture on the page opposite he is gauging the fuel in one of 058's big wing tanks

ments, and squeeze themselves into their seats. Stoke takes his place on the flight deck, three stories above ground. The second engineer stands behind him, ready to help. The ship taxis into position on the apron. They will have an hour on the line, now, while Stoke warms his engines. The cabin temperature hovers near 120 under the searing Texas sun.

The clock approaches 5 o'clock—1700 hours, in military talk. The aircraft commander checks with each crewman over the intercom. Finally the lead ships begin taking off, three minutes apart. Number 058 moves closer to the head of the runway. Then its turn comes. Stoke applies taxiing power, and the pilot wheels the ship in line with the runway, and clamps on the brakes.

"Engineer, this is pilot. Are you ready for take-off?"

Stoke scans his gauges as he revs up the six reciprocating engines. "Power checks okay. Engineer ready for take-off."

"Roger. Give me jets." The second pilot reaches overhead, pushes forward four throttles. Four jet engines leap to life, and Number 058 begins to squirm as its brakes hold it back. "Jets on 96 per cent," the second pilot says.

"Engineer, give me take-off power."

With a single motion, Stoke starts his six engines toward peak power. Number 058 begins to dance down the runway, fighting its brakes.

"Engineer to pilot. Power stabilized. You've got it."

The aircraft commander clears quickly with the control tower, then lets up on the brakes. Number 058 begins the long pull to lift its weight off the earth. With ten engines urging it on, the plane gains speed and finally reaches for the sky. Fort Worth drops away under the left wing; the jets are cut off, the six piston engines are pulled back to cruising speed. The mission is under way. Number 058 drones on toward the horizon.

1900 hours. Stoke has just had his third cup of coffee. The gauges are normal, everything goes well. But then. . . .

"Pilot, this is engineer. Number five engine is backfiring bad. I'll try water." Stoke touches a control that injects a stream of water into the cylinders of number five engine. The sudden cooling retards detonation. Number five coughs, then returns to normal.

"Pilot, I think I have number five okay. But she's eating fuel. I'll watch her."

"Can we make the mission if we lose number five?"

Stoke does some figuring. Hours to fly . . . extra fuel consumption if they have to maintain formation speed later with five engines . . . higher speed required for the bomb runs. . . .

"We can make it. But close."

"We'll keep going." The Old Man does not think highly of crews that can't complete missions.

2100 hours. Night now, dark and gusty. Tiny hamlets sparkle four miles below, when the clouds separate. Most of the crew members are at ease near their station, or sleeping. The radio man lets his relief take over; then he opens a round door, lies down on a tiny platform on tracks, and pulls himself through a long tunnel to the aft compartment, where there are six bunks.

"Pilot to engineer. We're going on George now."

So the pilots want to relax, too. They're entrusting the ship to George, the automatic pilot.

The second engineer brings Stoke a dinner that has been heated on an electric cooker—steak, potatoes, vegetables, coffee. Stoke eats as he watches the dials.

0200 hours. Two o'clock in the morning. Chicago is behind them. Stoke is returning to his station, which has been under the eye of the second engineer for an hour.

"How goes?" Stoke asks.

"Number five engine," the second engineer says, "I don't like it."

The gauges of number five are moving erratically. Stoke fiddles with the controls, and the engine settles down briefly.

"Radar to pilot. Big storm ahead."

"Engineer, this is pilot. If we go around the storm, can you make up the time between here and Spokane?"

"We can make up the time. But it'll cost fuel. If we lose number five, we won't have spare fuel."

"Navigator, this is pilot. Keep on course. We'll go through the storm."

Storms, mountains, dark, dark night. . . .

0500 hours. A faint glimmer of daylight steals into the flight deck. Stoke's eyes are red, his face stubbled with beard.

"Right scanner to engineer." The message is from a gun station aft.

"Go ahead, scanner."

"Number four is shooting smoke."

This is a time to be calm. Airplane engines catch fire occasionally; nothing to worry about. Take it easy. But, with number five already acting up. . . .

Stoke's gauges show number four to be performing correctly. But then the needles go awry, suddenly.

"Pilot, I'm feathering number four."

Stoke shuts off the fuel to number four, but lets the engine run until it uses up all the gasoline in the line. Then he feathers the propeller so there will be no drag on the engine. He half rises from his seat, and peers out the window. The stream of smoke thins out, then disappears. Stoke can almost feel the tension ease among the crewmen throughout the ship. He computes his fuel situation again.

"Pilot, number four is out for good. I

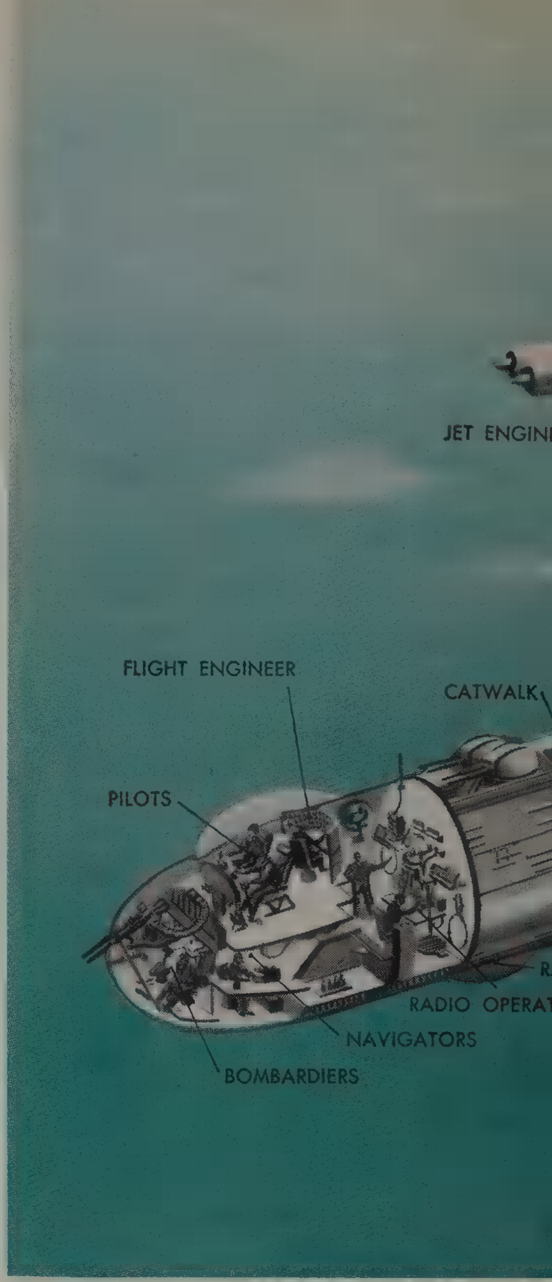


figure we can still make the mission, if number five holds out. But close."

"Roger. It's time to climb. Get ready."

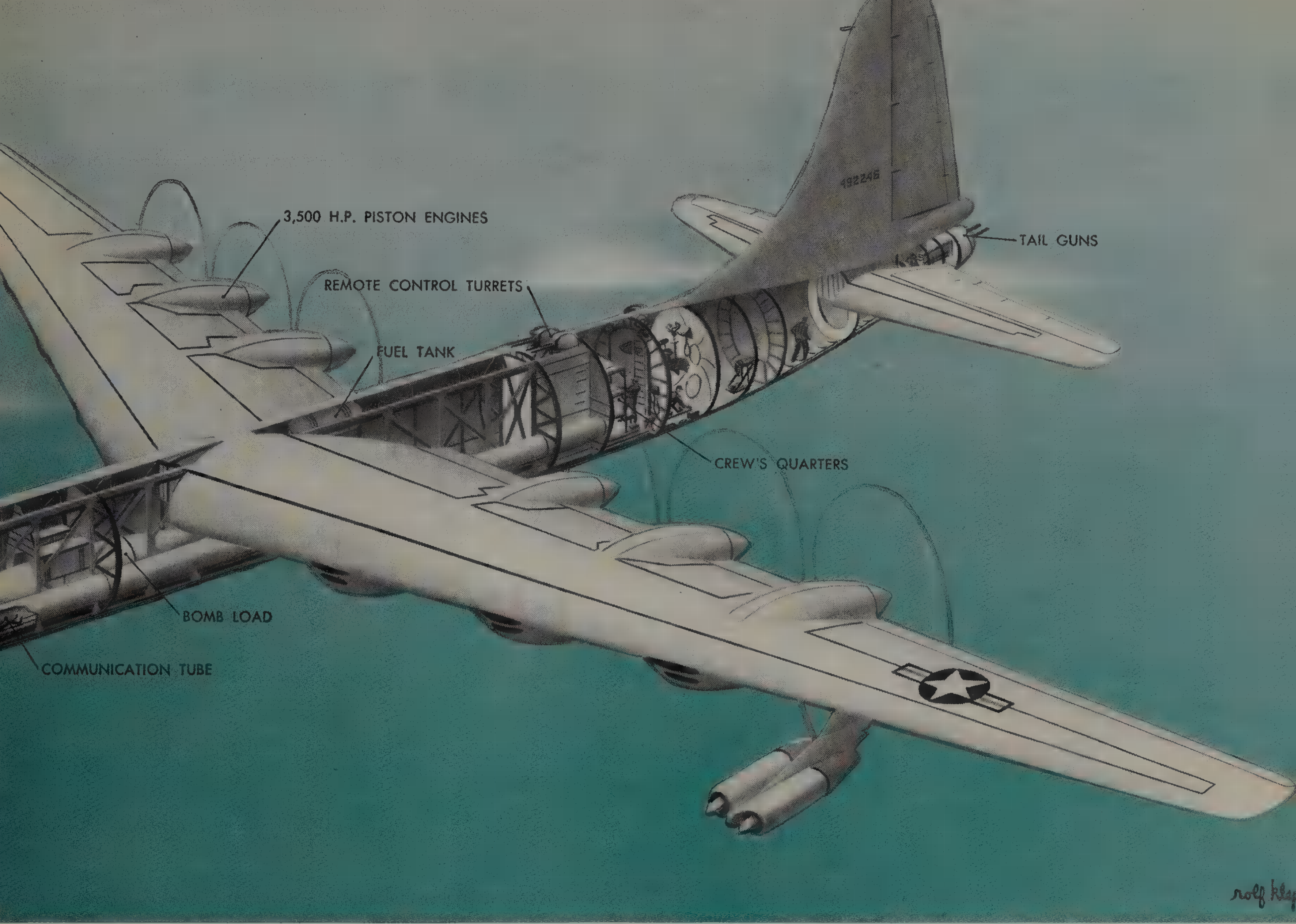
The crewmen pull on their heavy high-altitude suits for the climb to 38,000 feet, precaution against sudden loss of pressure if a port hole should blow out. Stoke turns the cabin heaters up somewhat. It gets cold up there, maybe minus 50 degrees outside.

. . . . Sacramento . . . San Francisco . . . radar bombing of a target while a special ground crew scores the formation for bombing accuracy . . . New Mexico, and live bombing. . . .

The great flat of the bombing range lies ahead. The B-36's pull out of formation in pre-arranged order for the bombing runs. Number 058 awaits its turn, and then. . . .

"We're on the bombing run," the pilot says. Every man is at his station—gunners feinting with fighter interceptors, pilots steering straight down the track, engineer revving up his engines. Number 058 races over its target seven miles below.

"Bomb away," the intercom reports. Number 058 joins the other ships in formation as they pull out of their bombing runs. But the crew has time to see the result of its bombing: easily within the mar-



SIX PISTON ENGINES, plus four jets for take-off and emergency power, propel the B-36. Note the tube connecting nose and tail spaces

gin that General Irvine allows for altitude bombing.

On to Memphis, for another radar bombing run . . . coffee and fruit juices . . . thunderstorms and clear weather and more storms . . . rugged beards and sweat and the deep kind of fatigue that comes of nervous and physical exhaustion . . . one- and two-hour naps every so often . . . more dinners prepared on the electric heater . . . day fades into night again, another night . . . Number 058 hums on. . . .

2100 hours. The home stretch. Think of a shower and a cool drink and sleep. Number 058 rides lightly now; its bombs are away, its fuel is low, even its original 1,200 gallons of oil are shrunk as the engines have been drinking up gallons of lubricant an hour. Stokum's tired eyes scan the gauges. He tinkers with his slide rule, and frowns at the answer he gets.

"Navigator, this is engineer. What's our ETA at Carswell?"

What's our Estimated Time of Arrival? The crew listens closely for the reply. When the flight engineer starts worrying about how much longer the flight will last, it could mean. . . .

"ETA is 0100 hours."

The slide rule works again. "Pilot, number five is kicking up badly, using too much fuel. I'm going to feather it. That'll give us two engines out, both on the right side. You'll have to trim for it."

The pilot adjusts his controls to counter the sideways pull of three engines tugging on the left against one on the right.

Stoke speaks into the intercom. "And you'd better get the weather at Carswell. I figure we have half an hour's fuel to spare."

The weather at Carswell is good. The crew sits back to wait out the ordeal. Four engines can carry a B-36 anywhere. Three engines can maintain altitude. But remember the B-36 that lost power on three and then more engines on a routine flight? It ended up a heap in a pasture.

"Pilot, try to trim her better," Stoke says. "I'm not getting the airspeed I should be getting for my power settings."

The pilots carefully adjust their flight controls to try to squeeze a few more miles an hour out of their four working engines. Number 058 responds.

"That's good," Stoke says. "We'll make it."

Three minutes before 1 A.M. the ship touches its wheels on the long Carswell landing strip. Several ships are on the ground already, others are in the landing pattern behind them. Everybody came home. Crewmen climb down the ladders and board a bus that takes them to wing headquarters. Stoke enters the office of the wing flight engineer for the procedure known as debriefing.

"Worse flight than usual," Stoke says, dunking a doughnut in coffee. "Trouble in number four engine—might have been a fire. I don't know. And number five needs some looking at. Backfiring, lost cylinder pressure later." He fills out the forms that will guide the ground crew in preparing 058 for another mission. "We didn't do so good on fuel this time. The way I figure it"—he manipulates the slide rule again—"we should have come back with 180 gallons more than we did. Must have been those two engines fouled me up."

"Go home and get some sleep," says the wing flight engineer. "You're off until this evening. Briefing tonight at 2100 for a training mission. . . ."

THE YOUNGER GENERATION

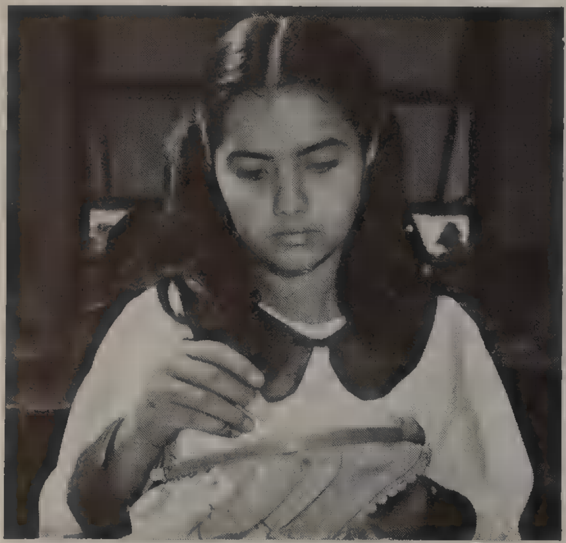
THE children pictured on these pages live continents apart and speak tongues unintelligible to each other but they have this in common—their fathers all work for companies in which Standard Oil Company (New Jersey) has an interest.

These young people are engaged in a serious business of their own—the business of growing up. And because their fathers go where oil takes them, that is where they must grow up, be it jungle or desert or plain or mountain.

Wherever the oilman moves his family, communities grow with all the things that are required for daily life—the houses, the churches, the schools, hospitals and recreational facilities that are brought into being by the cooperation of the companies concerned and local governments.

Given such prerequisites, childhood is much the same the world over, regardless of climate, custom and tongue.

IN INDONESIA, the very small son of a refinery worker waits for father at the ferry landing gate



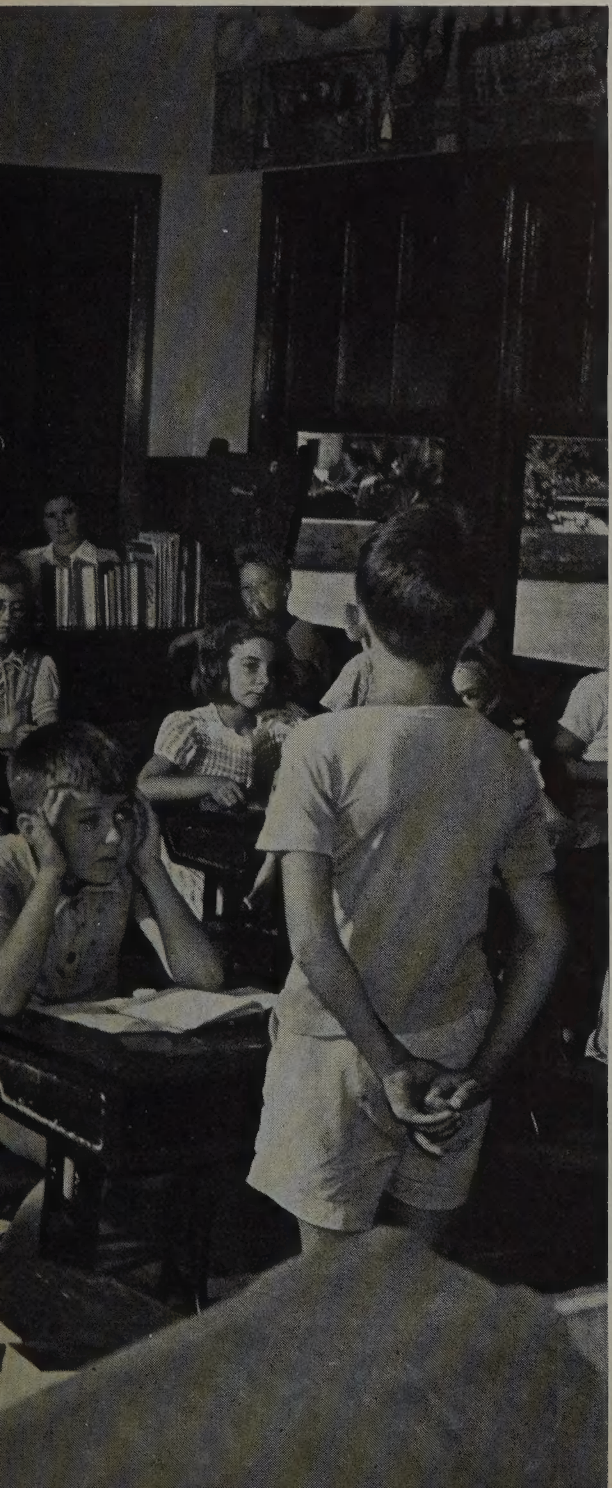
IN VENEZUELA, a schoolgirl in sewing class gravely concentrates on making her stitches beautiful

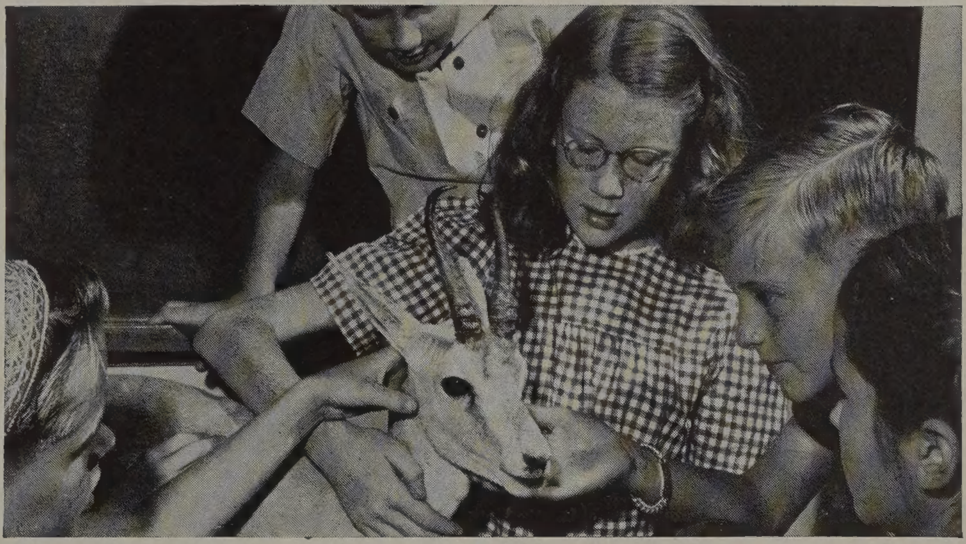
IN IDAHO a geologist's sons vacationing outdoors examine fossil specimens with a magnifying glass

IN FRANCE, a bright-eyed girl looks at the world from kindergarten and finds it exciting

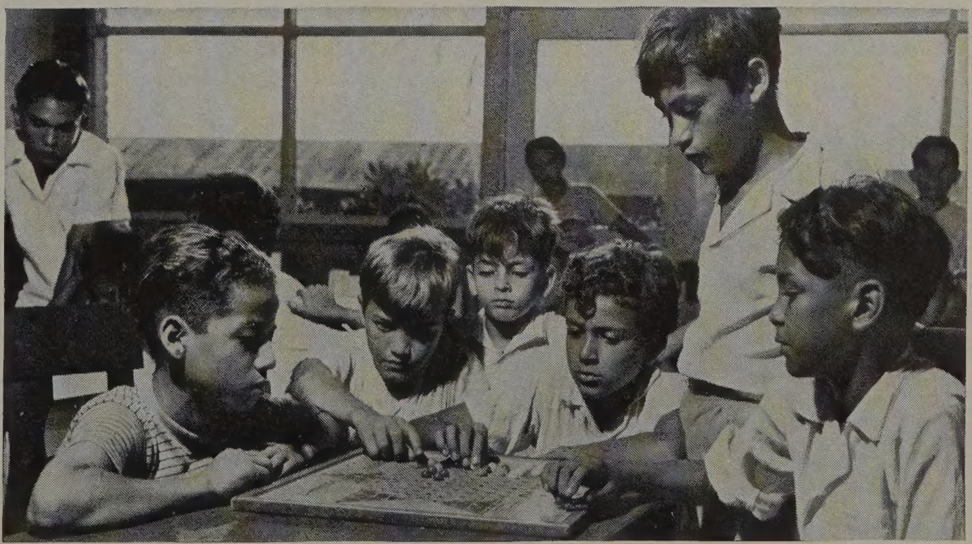
IN PERU, these little boys in a rural school appear to be taking the business of getting an education very seriously indeed. Note the caps hung neatly on pegs

IN ARUBA, fourth graders show a variety of reactions as their classmate stands to recite





IN ARABIA, American youngsters who have gone abroad with their parents get a living lesson in natural history. The animal is a gazelle, a species of antelope



IN COLOMBIA, a spirited game of Chinese checkers engrosses onlookers as well as the players. The battle is being fought in the recreation room of a boys' club

MALCOLM C. DIZER, who wrote this article, adds a new stamp to the collection which gave him the idea for a novel post-retirement career

MY SECOND CAREER

I AM writing this aboard the *Esso Zurich*, where I am purser-pharmacist's mate. This is almost my last voyage for the Esso Shipping Company. I am nearly sixty-five now and due soon to retire. On November first I'll be coming ashore to stay.

It's not going to be easy, leaving the sea and my shipmates and a job I've loved. But, believe it or not, at an age when many people draw a deep breath and sit back to relax, I'm starting out on a new career with as much enthusiasm as though I were twenty-one. There will hardly be enough hours in the day for the work I want to do.

When I read the recent article in THE LAMP which told how important it is to plan ahead for retirement, it occurred to me that the story of what I am going to do might be of help to others who are beginning to think about retirement.

I am not beginning my new career out of the blue. It is something for which I have been planning and working in my spare time for many years. It had its start in one of the most widely shared hobbies in the world—stamp collecting. But I am incurably inquisitive by nature, and long ago I saw that just collecting stamps would never satisfy me. Every time I came across a new stamp, I found I wanted to know something about it. Looked at in this way, stamp collecting became a key which opened the door on a world of fascinating information. My research led me down odd byways, to the stories of far lands, of historic battles, of the lives of great inventors, artists and writers.

Even so, this would not have added up to a full-time practical retirement career until I hit on the idea of combining it with another interest of mine—selling. I love to sell, and what better product could you have than something you had put together yourself while enjoying every minute of it?

It all began quite by chance, as so many things do, back in 1936. Edward the Eighth had just abdicated, and this country was in a furor about it. It had long been my custom to send Christmas cards to my friends built around topics of current interest, and that year I naturally decided to use Edward.

Then, while I was browsing through a catalogue, I ran across a collection of Edward stamps, and it struck me that they would make an attractive addition to my card. I mounted the stamps on one side of each card, and on the other I had printed Edward's abdication message. Then I sent them out to my friends.

The response took me completely by surprise. Not only did my friends write to ask if they could get additional copies, but I had offers from people I had never heard of who wanted to buy them.

At that time I had just retired, having finished my working career (as I thought then) as European sales representative of a large American firm. My family had scattered and, feeling rather at loose ends, I was looking around for something to keep myself busy. Since people had already volunteered to buy my Edward cards, I decided to try to merchandise them.

THAT first venture turned out to be fairly successful, but what was more important to me, I had found a really absorbing hobby. I went in for stamp collecting in a big way, choosing commemorative stamps as my specialty. And whenever an issue came out that interested me I started to dig through old books and records, looking for something that would enhance the meaning of my stamps.

Sometimes I dug up and put together factual information, but often I would find quotations from famous writings, or possibly a bit of poetry that seemed suitable. Now and then I ran across drawings or photographs that I could use. When I had found what I wanted, I would take my findings home and arrange them, along with the stamps, into little booklets which I had published. Then I would look around for people who might want to buy them.

Living as I was in retirement, I was free to give all the time I wanted to my "history in philately," as I called it. But then, just as I was really getting under way, the war came. Even though there wasn't much for an old fellow to do, I wanted to get a front row seat in the affair. It took a long time, but in 1943 I finally landed a job as a purser with the Maritime Commission.

That job gave me the front row seat I wanted: on ships that traveled back and forth across the Atlantic, carrying troops and supplies to the battlefronts of Sicily, Italy and, finally, southern France.

It also gave me my first taste of the sea, and I fell in love with it. So, after the war was over, I decided that if I could stay on a ship I'd keep on working. I was fifty-nine then, but I took a four months' course at pharmacists' school to get my purser-pharmacist's license. I won it, but I think it was just about the toughest course of study I ever took.

Then, in 1947, I enrolled in a refresher course the government was sponsoring at Sheepshead Bay. A lot of my classmates were people from Esso Shipping, and their enthusiasm for the company got me so excited that I decided to try to get a job with Esso too. I confess I had some qualms about my age, but I went to New York for an interview, and much to my surprise, they took me on, assigned me to a tanker, and I sailed that afternoon.

I've been at sea for nearly nine years now, and even though I've been away more than I've been home, I've never let my hobby go. I've always had some spare time on shipboard to work on my little books, and I've crowded every hour that I've been ashore on leave, doing my research, laying out the booklets, seeing the printer and, of course, looking for new customers.

In these years I've somehow managed to squeeze in the time to prepare and publish seven booklets. They are all different from each other, in size and design and subject matter. One of them, for example, the largest I've ever published, is a set of seven folders based on the stamps honoring famous Americans, which came out in 1940. And there's another, the last one I did, which tells the story behind two Liberian stamps that were issued to aid in that country's current literacy campaign.

Now that I am ready to retire, I am all set up with several thousand of these and my other stamp brochures waiting for me at home. I plan to begin finding customers for them just as soon as I come ashore in November, and then I'll start getting material together for another one.

Actually, this will be my second retirement. I guess I'll be too busy ever to think about a third.

THE ESSO BUILDING, a late addition to Rockefeller Center, is just four years old. Its thirty-three stories are occupied by the home offices of Esso Standard Oil Company and other affiliated companies


ESSO BUILDING

LIFE STREAM OF A MECHANIZED WORLD

Petroleum lubricating oils range from a clear, water-white oil that is placed by a hypodermic needle, a drop at a time, on the tiny bearings of a B-36's gyro-compasses, to a thick, black oil that is sloshed onto the massive gears of a giant rock crusher. So specialized are "lube" oils that Jersey affiliates in this country alone manufacture more than 800 different kinds.

Friction fighting long ago ceased to be the only characteristic required of a lubricating oil. In today's automobile engines it must also withstand extreme temperature changes and high pressures; must not form excessive carbon, corrosive acids or sticky coatings; must hold in suspension contaminants that would otherwise accumulate on engine parts. Such characteristics are "built in" an oil by refining portions of selected crude oils, then compounding them with chemical additives. The diagram below shows the principal processes by which a refinery produces the oils that keep a mechanized world rolling.